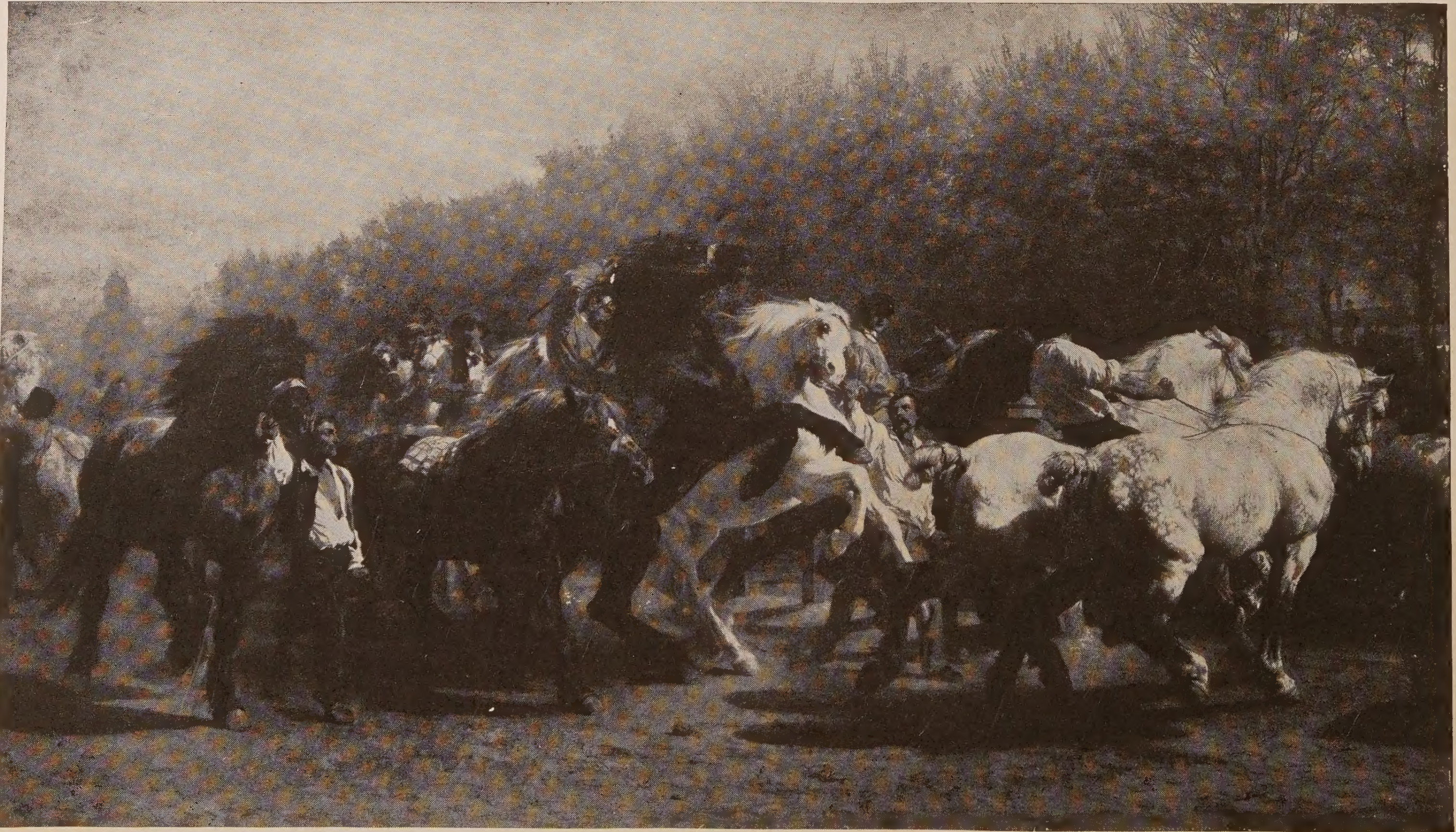
THE BOOK *of* KNOWLEDGE

THE HORSE FAIR



The Horse Fair is perhaps the best known of the paintings of Marie Rosa Bonheur, who is the most famous woman painter of animals. The original of the Horse Fair is exhibited in the Metropolitan Museum, in New York City, but a smaller replica of this beautiful work is in the National Art Gallery in London. Her studio and home near the Forest of Fontainebleau is world-famous, and during the Franco-Prussian War was respected by order of the Crown Prince of Prussia.

The Book *of* Knowledge

The Children's Encyclopædia

EDITORS-IN-CHIEF

ARTHUR MEE
Temple Chambers, London

HOLLAND THOMPSON, Ph. D.
The College of the City of New York

WITH AN INTRODUCTION BY

JOHN H. FINLEY, LL. D.
Late President of the College of the City of New York
Commissioner of Education of the State of New York

DEPARTMENTAL EDITORS

All Countries
M. Alston Buckley

Natural History
Ernest Ingersoll

Plant Life
Edward Step

Book of Wonder
Arthur Mee

Familiar Things
Harold Begbie

Men and Women
Ernest A. Bryant

Our Own Life
C. W. Saleeby, M.D.

Famous Books
J. A. Hammerton

School Lessons
A. M. Skinner, B.S.

Poetry and Rhymes
A. Von Hartmann

Dominion of Canada
W. Peterson, D. Litt., LL. D.

The United States
Holland Thompson, Ph. D.

The Earth
Ivin Sickels, M.S., M.D.

Golden Deeds
M. Perry Mills

Stories and Legends
Edward Wright

Things to Make and Do
E. R. Sayre, B.A.

Volume XIV

New York: THE GROLIER SOCIETY
London: THE EDUCATIONAL BOOK CO.

Text and Illustrations in this work are protected
by copyright as follows:

Copyright, 1911, 1912, 1918, 1919, 1921, 1923, by The Grolier Society

Copyright, 1911, 1918, 1921, by The Educational Book Co.

Copyright, 1910, 1911, 1912, 1918, 1919, 1921, 1922, by M. Perry Mills

Copyright, 1908, by Amalgamated Press, Ltd.

Copyright, 1868, 1870, 1872, 1874, 1875, 1876, 1878, 1881, 1883, 1884, 1886, 1887, 1888, 1889, 1890, 1891, 1902, 1906, by Ticknor & Fields, James R. Osgood & Co., and Houghton, Mifflin & Co.

Copyright, 1874, 1880, 1892, 1894, 1895, 1896, 1904, 1908, by Charles Scribner's Sons

Copyright, 1908, 1909, by The Century Co.

Copyright, 1897, by Harper & Bros.

Copyright, 1906, by The Baker & Taylor Co.

Copyright, 1901, 1902, 1906, 1907, 1909, by H. C. White Co.

Copyright, 1897, 1907, by The American Book Co.

Copyright, 1890, 1899, by James Whitcomb Riley

Copyright by Photographische Gesellschaft

Copyright by Keystone View Co.

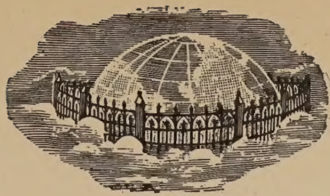
Copyright by Underwood & Underwood

Copyright by Brown Bros.

Copyright by Brown & Dawson

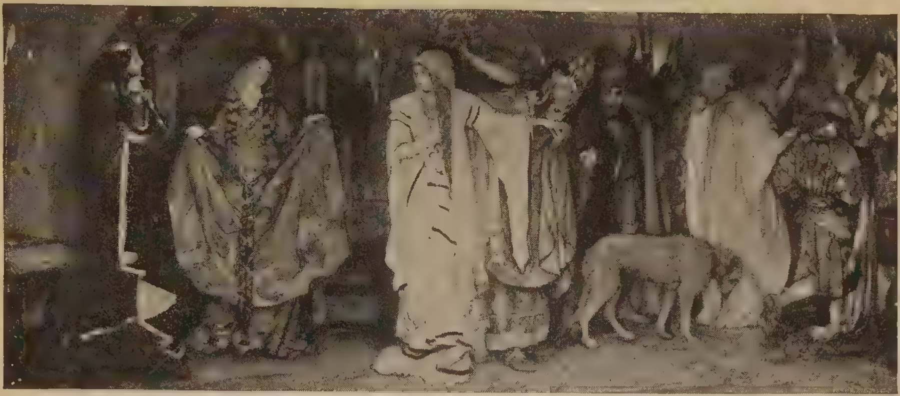
Copyright by B. L. Singley

The poems by Thomas Bailey Aldrich, Phœbe Cary, Ralph Waldo Emerson, Oliver Wendell Holmes, James Russell Lowell, John Greenleaf Whittier, Henry Wadsworth Longfellow, Edmund Clarence Stedman, Richard Watson Gilder, John Hay, Edward R. Sill, Bayard Taylor and Celia Thaxter included in this work are reprinted by permission of, and by special arrangement with, Houghton Mifflin Company, the authorized publishers of the Works of these authors. The poems by Robert Louis Stevenson, Eugene Field, Mary Mapes Dodge, Richard Henry Stoddard and Henry Van Dyke included in this work are printed by permission of Charles Scribner's Sons.



CONTENTS OF THIS VOLUME

This is a short guide only to the principal contents of this volume. It is not possible to give the titles of all the Poems and Rhymes, Legends, Problems, color pages, questions in the Wonder Book, and many other things that come into the volume; but in all cases the pages where these parts of our book begin are given. The full list of these things comes into the big index to the whole work.



A PICTURE BY EDWIN A. ABBEY FROM SHAKESPEARE'S PLAY KING LEAR

MODERN PAINTERS OF THE UNITED STATES

CONTINUED FROM 4222

YOU remember that in an earlier story we mentioned the name of George Inness as among the first of the American painters who saw the advantage of going abroad to study. He spent some time in Rome and in Paris, but, nevertheless, he was to a great extent self-taught. He was one of those men who study deeply and analyze for themselves all their teachers give them, but who never imitate the work of others.

He was born in 1825 at Newburg, N. Y., where as a boy he was apprenticed to an engraver. He was not strong and the close work proved too confining. He went to New York and studied for a time with a French artist. In 1850 he made his first trip abroad. His passion for nature, for beauties of skies and fields and trees, for masses of foliage, strengthened with his skill for portraying them. His early work is sometimes considered too finished in detail, showing the influence of his early training in engraving. He excels in conveying moods of nature, not only the beauty of a given scene but the way it makes us feel. He died in 1894, leaving a great and permanent contribution to American art. His son and pupil, George Inness, Jr., also became a landscape painter of note.

In thinking of American landscape painters, we always group together George Inness, of whom we have just spoken, and two younger men, Alexander Wyant and Homer D. Martin. As you may see by comparing their pictures, their work was not at all alike, but they worked at the same period and these three great men are looked upon as "the fathers of modern American landscape painting."

Alexander Wyant, who painted nature with a rare gift of poetic sentiment, was born in Defiance, Ohio, in 1836. He very early showed talent for drawing. When he was about twenty he visited Cincinnati and there for the first time had an opportunity to see fine pictures. He was especially charmed by one of George Inness's landscapes, sought out Mr. Inness in New York, and acting upon his advice, resolved to become an artist. He went abroad and studied under Gude, a graduate of the Dusseldorf school. Soon after his return, needing money, he entered the employ of the Government on a trip to explore the West. His health gave way under hardships and his companions put him aboard an eastbound train. Although it passed through his home town brave young Wyant determined not to give way to any weakness and continued on to New York to resume his art work. He was never entirely well again, and had to work with his left hand. Feel-

Copyright, 1911, 1918, by M. Perry Mills.

ing that his life might be short, he worked all the harder. Much of his work was painted in the Adirondacks, much in the Catskills.

Homer Martin was born in the same year as Wyant, 1836, at Albany, N. Y. His great talent was self-developed, for all the instruction he ever received was a few lessons from William Hart.

Martin had a defect of vision which caused much of the detail of nature to escape him. He saw things in mass and therefore that is the way he painted them, a method which many followed. He visited Holland, England, and France and formed many delightful friendships with fellow artists. Westchester Hills is by many considered his finest picture.

Winslow Homer was one of our greatest painters of ocean. Young and old enjoy his stirring pictures of fisherfolks and their lives, which he painted mostly along the Maine Coast. He was largely self-taught and always insisted upon painting things as he actually saw them, unmindful of conventional methods. He studied lithographing at first. During the Civil War he joined the Army of the Potomac, and the spirited drawings sent back to Harper Brothers soon won him fame. His finer work was not accomplished, however, until he became fascinated by the brave, simple people who live along old ocean and brave its perils for their daily bread. The Life Line, Eight Bells, Undertow are among his best known pictures.

AMERICAN PAINTERS WHO LIVE ABROAD

We now come to a group of painters who not only went abroad to study, but elected to spend most of their lives in Europe.

The first of these, James McNeill Whistler, who was born in 1834, is claimed both by England and America. He was truly an American, however. His father was in the army and he, himself, intended to enter the same profession. But at West Point he neglected his other work for drawing, and finally failed in his examinations. He then tried the Coast Survey, but his fingers simply would make pictures when they ought to be drawing maps, and after two or three years, he turned seriously to painting and went to study in Paris.

He first became known for his etchings, but his fame as a painter soon became world-wide. His training was world-wide too. Some of his portraits remind us of the work of Velasquez, the great Spanish artist, whom he much admired. In the early part of his career, when the Western world had just begun to discover the charm and beauty of Japanese art, he studied the Japanese prints and pictures, which he saw in Paris. They had a powerful influence upon him, and much of his early work brings us suggestions of the work of the best Japanese artists.

He was, however, no mere imitator. He gained a profound knowledge of the work of the masters, old and new, of both the Eastern and the Western worlds, and out of all this knowledge he created a method so original and individual that even if we know only a little about painting, we can usually recognize his pictures without hesitation. They are at the same time strong and delicate, and some of his portraits especially are very wonderful. The portraits of the White Girl, His Mother, and Carlyle, are well-known examples of those most characteristic of his brilliant original method.

Whistler saw beauty in everything, and in his painting, etching and writing, tried all his life to teach others to see it too. He used few bright colors, and his pictures may not at first appeal to us, but if we take time to study them, we shall end by loving them.

Elihu Vedder must be mentioned for his poetic and individual art. La Farge excelled him in richness of color, but perhaps no one excels him in skill in drawing, or in a strange fantastic imaginative charm. He has employed his talent in various ways—in illustrating books, in mural paintings, in mosaic, and in other pictures. Vedder had the advantage of studying both in Paris and in Italy, where he makes his home.

When you go to see the Boston Public Library, do not forget that one of the rooms is decorated with illustrations of the old story of the Holy Grail from our much loved Morte d'Arthur. The work was done by Edwin A. Abbey another American painter whose fame, even during his lifetime, became world-wide.

Edwin A. Abbey began his artistic career as a draughtsman, but in a short time turned to illustrating, and was well-known as an illustrator by readers of Harper's Magazine for a long time before

AMERICAN SCENES BY AMERICAN PAINTERS

Here we see an example of the work of F E. Church, entitled The Heart of the Andes. This artist painted subjects from the far North to South America, seeking always the impressive and magnificent. F. E. Church belonged to the Hudson River School, of which we have told you, and was one of the best painters of his day. You may read more about him in the first part of this story.

This picture, entitled Peace and Plenty, is a good example of the work of George Inness, though his later works were not done with so great detail as this shows. In coloring it is very beautiful and the evening sunlight, falling across the reaches of the river and the field of grain, lights up the whole picture. Inness, Wyant and Martin are grouped together as the fathers of modern American landscape painting.

he began to paint. He received his foreign training in England instead of in France, and for many years of his life, he made his home in an old manor house in Oxfordshire.

He is best known for his historical paintings, such as his scenes from Shakespeare, and to make them real, he studied carefully old books, and drawings, and illuminated manuscripts so that he might have a good knowledge of the dress and customs and manners of the people whom he painted. All his pictures gleam with beautiful coloring, especially the famous "Abbey red," and the figures with which they are peopled seem to be alive. They seem to speak to us from past days and tell us that the men and women whose stories he told with his brush once lived and moved and loved and suffered. He was so much esteemed in England that when Edward VII was crowned, Abbey was chosen to paint a picture of the coronation.

One of his friends was Frank D. Millet, who studied in Antwerp, and is best known for his mural decorations and what are called genre pictures, that is, for example, pictures of a room with a few figures in it as if living or working there. Although he made his home in England, the greater part of his mural painting was done in this country. His pictures are beautifully finished, his drawing is good, and all his work lifelike and real. He painted some portraits, but not many. He was drowned when the Titanic struck an iceberg and went down.

THE GREATEST AMERICAN PORTRAIT PAINTER WHO HAS YET LIVED

We now come to the greatest of our portrait painters—John Singer Sargent. He was born in Florence, Italy, in 1856, and the talent of the art-loving boy was developed by his early life in that wonderful city, where he had every opportunity of studying the work of the great Italian masters. He had the advantage, too, of studying in Paris under Carolus Duran, who was himself one of the foremost artists of his day. Sargent is a wonderful master of technical difficulties. It is true, that some critics say that he is so much in love with the technical side of his art, that he has not enough to spare for the spiritual side. They say that he makes a wonderful likeness of the man, or woman, whom he is painting, in the mood of the moment, but that he does not catch enough of the spirit within. To him, a weary old man is a weary old man, and little more. They say that he tells exquisitely the ageing of the man in the outlines of the body, in blue-veined hand and in wrinkled cheek, but that the portrait does not tell enough of the struggles that have gone on in the man's mind, throughout his life, and of the battles lost or victory won either for good or ill. The great masters could tell this story with brush and paint, and it is chiefly for this power that we call them great. Whether or not Sargent has this power in large measure, the fact remains that he is the greatest portrait painter of our time, and the greatest American portrait painter that has yet lived.

Sargent paints pictures of children with a tender sympathy that shows that he loves them. Although he lives most of his life abroad, he has spent some of his time in this country, and some of his finest pictures are portraits of Americans. His famous mural decorations in the Boston Public Library are among the first things that we look for in that beautifully decorated building. These great paintings occupied much of his time for a number of years, and it is said that he looked upon their execution as a labor of love.

SOME AMERICAN PAINTERS WHO STUDIED AT HOME

Although, as we have seen, from the middle of last century our young artists flocked to Europe to study, some American painters did not come under the influence of European teaching in their student days. One of these was Ralph A. Blakelock, who at the close of last century was one of the best American landscape painters, and some of whose pictures have been called "symphonies of color." He was an invalid for many years, and unable to paint, and his pictures were neglected and forgotten. After a time, however, some of his landscapes were sold for a good deal of money. People began to talk about the beauty of his work and he had the happiness of knowing that he was again remembered.

Albert P. Ryder, many of whose pictures attempt to illustrate great literary ideas, is another painter who studied at home. A third independent painter, but one who belonged to an earlier date, was George Fuller, who was born on a Massachusetts farm in 1822. His best known

LANDSCAPES, FRENCH AND AMERICAN

Though usually called a View on the Seine, this picture by Homer Martin was really painted in Normandy. This is an excellent example of his work and is of surpassing beauty. Its colors are exquisitely clear and soft, and the picture gives one a feeling of peaceful calm. The painter called the picture the Harp of the Wind. The painting of the limpid water, and the soft clouds in the sky is especially good.

Photograph copyright, 1910, by Metropolitan Museum of Art.

Some consider this one of the best examples of A. H. Wyant's work. It is entitled Forenoon in the Adirondacks. You can see the sunlight falling on the hills in the background, while the trees in front and the little pool lie in shadows. The picture is now owned by the Metropolitan Museum of Art, New York.

picture is Nydia, which is in the Metropolitan Museum of Art. He showed a great deal of feeling in both his landscape and figure painting, and it is this and the coloring in his pictures that attract us to them.

The test of knowledge is to be able to apply it to our own problems, and, from what we have learned, work out new ways of doing things. If we can do this, we can be sure that we have made knowledge our own. This is what American painters have done. For years they have been taking the best from all the foreign influences, and bringing them to bear in the home field.

SOME NOTED PORTRAIT PAINTERS OF RECENT TIMES

As we have seen, some of them elected to live abroad, but the number of those who have come home is legion. Among them J. W. Alexander, William M. Chase and J. Carroll Beckwith are three men whose names as portrait painters were household words for many years. None of the three was great, but they all did genuinely good work, which will probably be remembered and prized much as we remember and prize the work of the lesser English portrait painters of the eighteenth century. William M. Chase was noted also as a painter of lifeless objects, or still life, as artists say. His pictures of fish are especially good.

Thomas Eakins painted stronger portraits than any of these three men, but his work often lacks the grace which theirs possesses. Wyatt Eaton was a well-known portrait painter who lived at the same time as George Inness.

When we think of all the good pictures by American artists that we have seen, we realize how difficult it is to decide among them, while at the same time if we attempted to mention all the men and women who have done excellent work, this story would simply turn into a list of names.

Among the best known is George de Forest Brush, a pupil of the great French artist Gérôme. The strange picturesque life of the American Indians appealed to his imagination and in his early life he devoted his best talent to painting them. In Silence Broken, and Mourning Her Braves he shows much sympathy with this taciturn people. Of late years, he has taken to painting family groups, usually of a mother with her children, which give us something of the same feeling as the Madonna pictures of earlier days. Another artist who paints madonna-like women is Abbott H. Thayer, who thus idealizes the women of his native country.

There are many other portrait painters and figure painters of note among us. Thomas W. Dewing paints exquisite studies of women. Gari Melcher's portraits tell the story of freshness and simplicity in the young people whom he delights to paint. Robert Henri is another portrait painter of note, who gives us rich, harmonious pictures, and also paints richly colored pictures of trees, with light flashing between the trunks, and lighting up the dim recesses of the wood. Among women portrait painters the two who stand out most prominently are Mary Cassatt, who spends most of her time in France, and Cecilia Beaux. Mary Cassatt loves best to paint little groups of mothers and children, in soft, quiet colors. Like all really fine artists, her drawing is especially good, and makes the little ones in her pictures look like babies and children that are really alive. Cecilia Beaux paints brilliant portraits, of which other artists speak approvingly as good work.

MODERN LANDSCAPE PAINTERS WHO TRY TO PAINT LIGHT

When we look at the pictures painted by our modern landscape painters, we notice a great difference between them and the early American landscape painters. This is because they do not, like Doughty and Durand, try to put into the picture everything that the eye can see in the city street or the countryside. Instead they paint clearly the things that stand out with clearness, and for the rest give us what we call "impressions." Besides this, following the example first set by the English painter J. M. W. Turner, they pay a great deal of attention to the effect of sunlight, and the play of light and shade in the open air.

Childe Hassam, who has done much to draw attention to the picturesque side of New York, excels in this. He charms us with the reflected lights in the streets on a rainy day, or dazzles us with the brilliant colors that he sees in the sunshine of a summer afternoon. J. Alden Weir, who paints portraits, landscapes and interiors, also revels in light, but he gives us quieter colors to enjoy. D. W. Tryon teaches us to look for delicate

SPECIMENS OF THE WORK OF HUNT, WHISTLER, AND CHASE

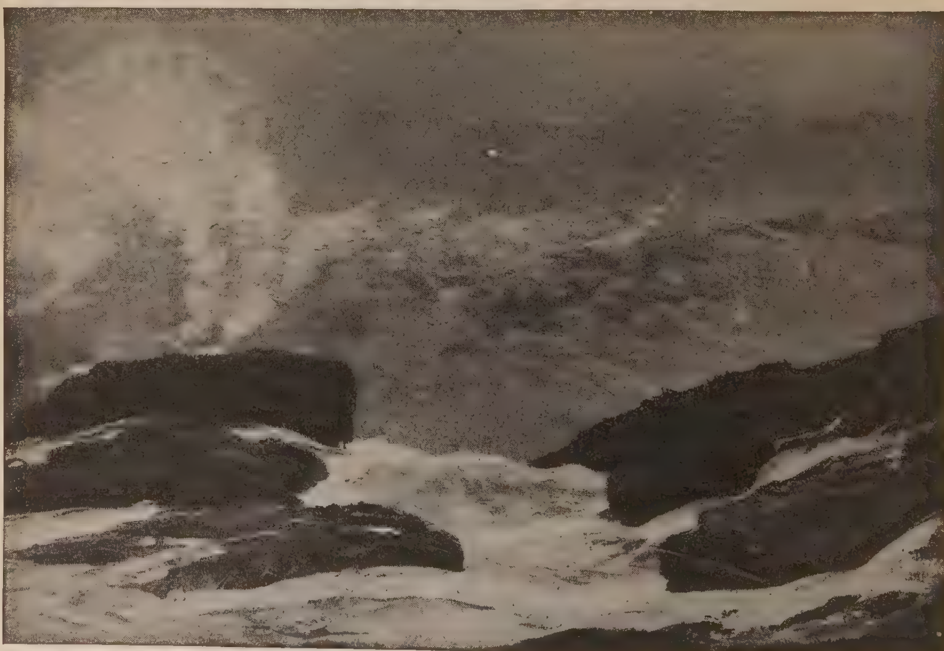
The Figure of a Girl was painted by William Morris Hunt, whose story is told elsewhere. It is interesting to compare his work with the other pictures on this page.

In this portrait of Henry Irving as Philip II of Spain, by James McN. Whistler, the painter has well shown how the actor lost himself in the character that he portrayed.

This picture of Carmencita, a Spanish dancer, is a good example of the work of William M. Chase. You can see that the figure is full of life and motion. A fine picture of the artist, by Sargent, is on page 4255.

PLACID FIELDS AND STORMY SEAS

In this landscape D. W. Tryon has succeeded in giving us the impression of the constant flow of water in the brook. The whole picture, with its leafless trees against a cloudy sky, breathes the spirit of winter. Notice how the break in the trees in the background gives the feeling of mystery, as if some unseen road led off into limitless distance. This artist is fond of painting just such quiet scenes as this.



In this picture by Winslow Homer, we have the strong surge of stormy waves breaking on the rocks of Maine. The artist has well contrasted the passive strength of the rugged rocks with the violence of the waves that are dashing themselves into spray and foam against them. The picture gives a good idea of the turbulence of the sea on a rocky shore.

All pictures in this story except Childe Hassam's picture of Fifth Avenue are reproduced by courtesy of the Metropolitan Museum of Art.

FIGURES BY FOUR AMERICAN PAINTERS

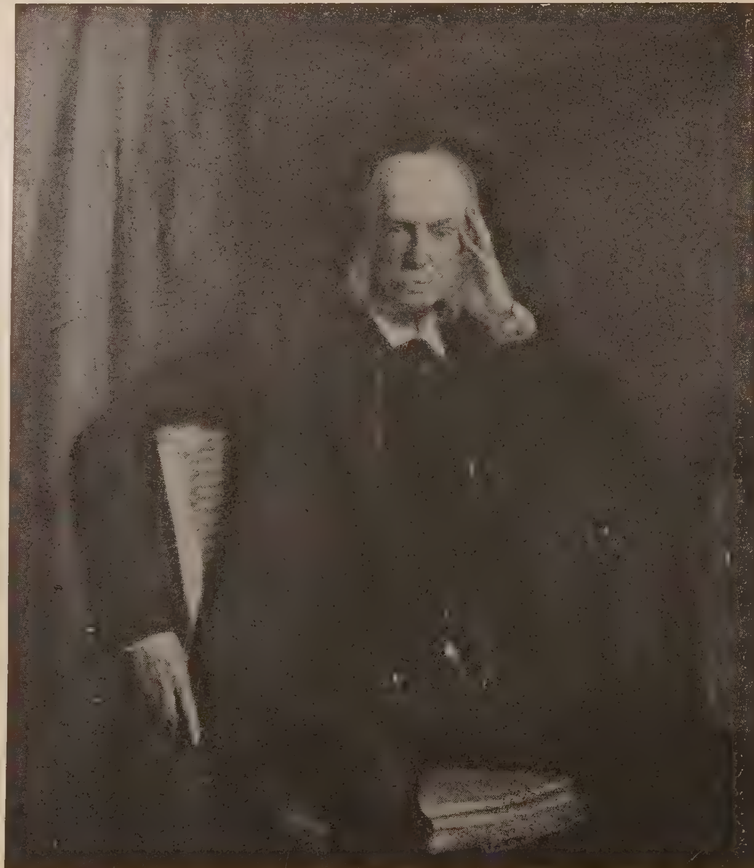
In this picture by Cecilia Beaux, the light on the intent face and girlish white-clad figure is accented by the dark woodwork. The picture is a good example of the brilliant work of this artist.

Mary Cassatt's Mother and Child shows well the tender care of the mother, who is drying her little one after her bath. The artist has given us successfully the happy look of a child fresh from sleep.

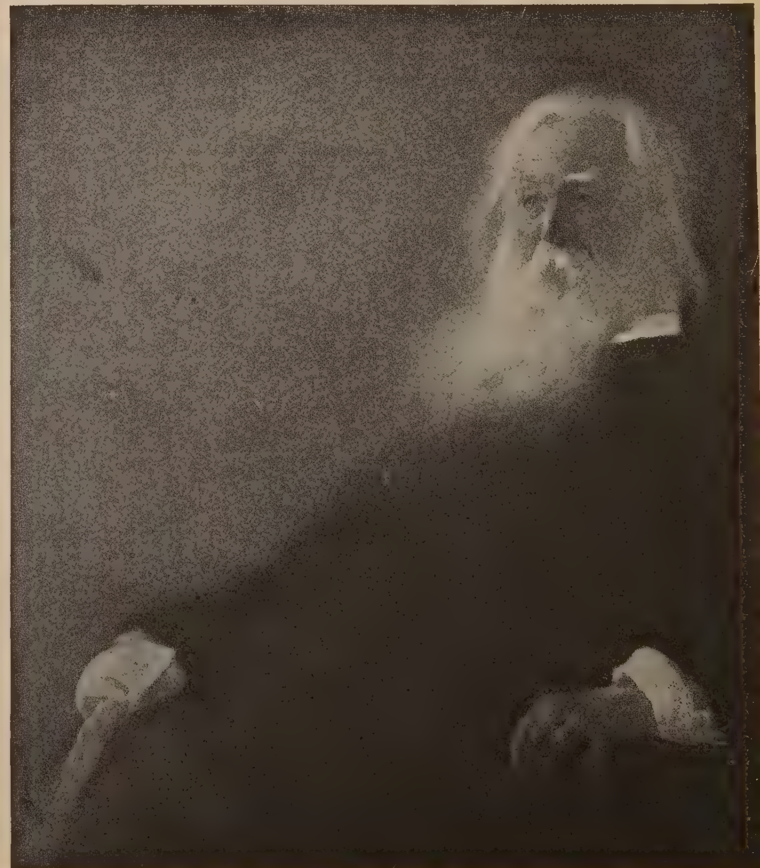
This portrait of William M. Chase is thought by many to be one of the finest examples of Sargent's work. The pose of the figure is remarkably fine and the whole picture shows the great artist at his best.

This figure of a young woman, by Thayer, might be a modern Diana. Although she is seated, her attitude and the way in which her weight is thrown on her hands gives her freedom of movement.

TWO FAMOUS PORTRAITS BY TWO FAMOUS MEN



This portrait of Henry Marquand, by John S. Sargent, is a delightful picture of a man in the evening of his life. As in all his work, Sargent has made the surroundings of his sitter very simple so that the attention is not distracted from the portrait.



John W. Alexander's work is always interesting, and his portrait of Walt Whitman, the "Good Gray Poet," is fascinating. There is something about the lion-like head which compels your attention. Some think this is Alexander's best work.

Here we have an "impressionist" picture by Childe Hassam. The artist has made nothing definite, but has given us his impressions of Fifth Avenue on a sunny day.

This picture by Thomas W. Dewing shows how much can be expressed by simple lines. The Letter on the low desk to the left gives the picture its name.

beauties in our landscapes, with beautiful feathery trees, or dimly lighted moorland veiled in a pearly mist. His pictures have a depth of spirituality and mystery that gives us a feeling of peace as we watch them. John W. Twachtmann painted landscapes and pictures of the sea which

In the Garden, by George de Forest Brush.

have a haunting beauty that no one can forget. Among women painters, Charlotte B. Coman gives us pictures of a country made to live in, with trees and houses bathed in warm bright sunlight.

THE PLACE OF MURAL DECORATIONS IN AMERICAN ART

Mural decorations now play a very important place in American art. Like the Italian city republics, of which we have read in another place, we have begun to beautify the walls of our public buildings with paintings, and, as in the old days, our best artists are called upon to do this work.

We have spoken already of La Farge's mural decorations and the great work done in the Boston Public Library by Sargent and Abbey. J. W. Alexander was also noted for his mural painting, and so is J. Alden Weir. Then there is E. H. Blashfield, who has painted the dome of the Library of Congress and many other fine wall pictures. C. Y. Turner, Will H. Low, Kenyon Cox, Frederick Dielman, and E. E. Simmons, have all given of their best to beautify churches, colleges, public buildings, and the walls and ceilings of private houses.

Many readers of THE BOOK OF KNOWLEDGE will have an opportunity of seeing the Library of Congress in Washington. When you do, do not think of it as one big, handsome building to be seen, but study its mural decorations carefully and store away their beauty in your minds. Every one of them was painted by an artist who strove to do his country honor.

Horatio Walker also paints mural decorations as well as landscapes of such force and charm as to place him among the greatest American landscape painters.

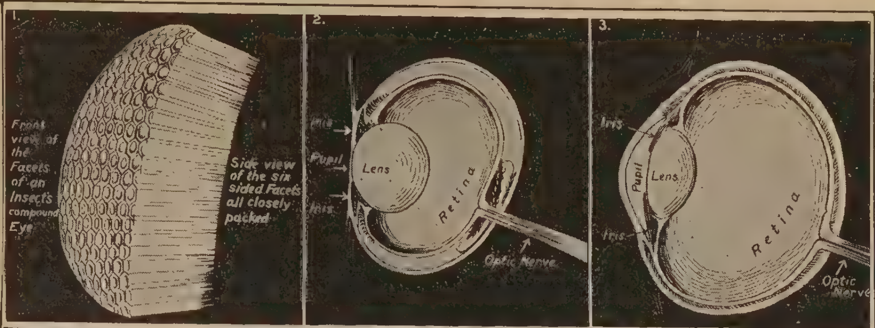
There are other men and women of whom we ought to speak. Leonard Ochtman, Elliott Daingerfield, Charles W. Hawthorne, Paul Dougherty, Frederick Ballard Williams, Lydia F. Emmett, and dozens of others deserve more than a mere mention of their names.

The work of these painters, and of others whom we have not space to name, is said, by men who know, to be at least as good if not better than the work of painters in the Old World.

Some day, perhaps, we shall follow the example of France and establish a museum as well as a library in each of our small towns. Then we shall be able to study and enjoy the pictures that our artists are painting for us, and we shall learn to honor them for the beauty that they bring into our lives.

To-day we have artists of whom we are rightly proud, who seek to show us, through their art, the loveliness of the hidden soul of things.

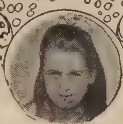
THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4359.



The first picture shows the eye of a fly, the second of a fish, and the third of a man, and we can see, by comparing these, how much nearer the fish's eye is to a man's than is that of an insect.

THE STORY OF THE EYE

CONTINUED FROM 4098



THE sense which we are now going to study is vision, or seeing, and the organ of this great sense, as everyone knows, is the eye. In many ways, this is the most wonderful and important of the senses. It is so for the purposes of practical living. It is more necessary to see than to hear, or taste or smell. A blind man is at a greater disadvantage than a deaf man. The progress and ascent of living creatures on the earth have very largely depended upon vision, and we have already learned that the vision part of the brain is largest in the highest forms of life. It is much larger in ourselves than in any other creature.

Vision is also of the highest importance for our ideas of the world in which we live, just as it is for our practical doings in that world. If we could not see we should know very much less of our own earth, and we should know the sun only by the radiant heat that he sends us; and all the other heavenly bodies would be unknown to us—from our own little moon to the millions of stars. It is upon our eyes, then, that our knowledge of the great world beyond our own earth depends, and on this claim alone our eyes are entitled to special respect. Unlike any of our other senses, they put us directly in touch with the infinite and the sublime. One of the greatest men who ever lived, Emmanuel Kant, said that there were two things which filled him with awe—the feeling of duty inside the minds of men and the starry heavens above us. Let us begin, then, by studying how, in the course of long ages, living creatures have been able to develop the eyes by which the starry heavens are seen.

This question of the history of the eye is deeply interesting. A short time ago we should have begun straight away with the history of the eye in the animal world. It would not have occurred to anyone that there was anything to say about eyes or seeing in the world of plants, but it has been discovered that something like seeing is not confined to the animal world. We find that certain especially sensitive spots are to be found on the leaves of plants. If we are really to understand our own eyes, therefore, we must begin at the beginning, with something much older and simpler than our eyes or any part of us.

The eyes of plants, if we may so call them, are very simple. The business of a green plant, and especially of the leaf of such a plant, is to receive and use the light that falls

upon it. It is therefore in the leaves of plants that we find their eyes. Simple experiments—which have now been made many times over, with many kinds of plants—show, to begin with, that somehow or other the leaf is sensitive to light. For instance, if the direction of the light is altered, in a very short time the leaf turns itself, so as to get the light fair and square upon its surface; and some leaves will do this as often as the direction of the light is changed. We may, perhaps, get rather wrong ideas if we say that the leaf sees the light, yet that must be what happens; only it is a very simple kind of seeing. It is, perhaps, rather like the very first kind of seeing that is done by a new-born baby.

THE LITTLE EYES BY WHICH A LEAF CAN SEE

After it had been completely proved that somehow or other the leaves can see, the next thing, of course, was to find whether the leaf saw as a whole, or whether it had any special places where it saw—places which must be called eyes of a kind. When the surfaces of leaves were carefully examined, it was often found that there were places where there was developed a kind of simple eye. That is to say, certain of the cells forming the surface of the leaf were made of a special shape; it was found that the outside of these cells is curved, just as the front of our eyes is curved.

The consequence is that light falling upon these cells is focused, as we say, and thrown upon the floor of the cell, just as a curved piece of glass will focus the sun's rays and throw a bright spot on a piece of paper. If the leaf is at right angles to the light, then the bright spot made in this way will fall right on the middle of the floor of the cell.

WHAT HAPPENS WHEN A LEAF DOES NOT LOOK STRAIGHT AT THE LIGHT

This corresponds to what happens in our eyes when we are looking straight at a thing, and the picture of that thing falls, as we shall soon learn, upon exactly the right place at the back of our eyes——the place where we see best. But when the leaf is not facing the light—not looking straight at it, as we might say—the little bright circle that should fall upon the middle of the floor of the cells is thrown somewhere to one side of the floor, or may even be thrown not upon the floor of the cell at all but upon one of its walls; and the life of the cell knows the difference.

Of course, these discoveries have excited the greatest interest among those people who care for these things, and at first, as was quite right, many doubts were expressed, but these have all been cleared away. In the first place, it was necessary to prove that the curving of the surface of the cells really made them act like little lenses.

In two ways this can be proved: either the surface of the leaf can be, so to speak, shaved down, so that it becomes flat, or else a little water can be laid on the leaf and then covered with a thin sheet of glass, in such a way that the water fills up the hollows between the cells, and so makes the leaf flat, whereas before it was covered with hundreds of little bulging eyes.

When these experiments were made, it was found that the plant no longer responded to the light; the leaf no longer turned so as to face the light directly—in a word, it no longer knew where the light came from. Its sight had been spoiled, just as our sight would be spoiled if something of the kind were done to our eyes.

PHOTOGRAPHS THAT CAN BE TAKEN WITH THE EYES OF A LEAF

And then, still more lately, the power of these little eyes was proved in another way. If these cells with their curved fronts really act as lenses, then, with care and skill, it ought to be possible to make them take photographs—that is to say, it ought to be possible to use these little cells as the lenses of a hundred tiny little cameras. This has been done, and the most excellent photographs have been taken—photographs so good that the person photographed can quite easily be recognized when the photograph is magnified and thrown on a screen.

This subject is quite new, and we are only at the beginning of our knowledge of it. A beginning has been made, however, with a new chapter in our knowledge of plants and their wonderful lives. Here, it is sufficient just for us to know that plants, which live by the light of the sun, and upon whose life our own lives depend, have little eyes of their own, which they use for their lives, and therefore, in the long run, for ours. It is because all animal life depends upon plants that we should know these things. And now we can go on to

study the history of the eye in the animal world.

In the very lowest forms of animal life we find that there is response to light, for we find that some of the simplest kinds of animal will always travel from shadow into the light, and others will always travel from light into shadow. These are creatures whose bodies are so simple that we should not look for any special organ of vision.

HOW THE FIRST TRACE OF AN EYE IS FOUND IN THE SKIN

Probably the first trace we have of such an organ—that is to say, the first trace of an eye—is where we find that, in certain lowly animals, parts of the skin are very sensitive to light. We find in such cases that the color of the animal changes according to whether it is in light or in darkness or in shadow, and when its skin is examined under the microscope, we find that it contains a large number of cells packed with colored material.

This is usually called pigment, which is simply the Latin for paint—in fact, another form of the word paint. These pigment-cells are sensitive to light. When light shines on them, all the pigment is gathered tightly up into the body of the cell; but when the light is taken away, and they are in shadow, the pigment strays out in all directions from the centre of the cell, and so is scattered.

This explains why the color of the animal changes, and it also tells us why and how the animal is able to know what the state of the light is, and to act as it pleases accordingly. In the study of the history of the eye, great stress has always been laid upon these pigment-cells; but now that we have discovered such wonderful eyes in leaves, fitted with lenses so perfect that they will take photographs, the pigment-cell, which we look upon as the beginning of the animal eye, seems to be a very poor affair compared with a plant eye.

THE LITTLE CELLS IN THE SKIN UPON WHICH LIGHT ACTS

We do not know exactly how it is that light affects the pigment-cells, but we may be sure that the action is really a chemical one. Everyone who is interested at all in photography knows that light has a chemical action—as, for instance, on the salts spread on a photographic plate. Every housewife whose curtains fade, or who puts clothes out to be bleached, knows also that light has a chemical action. Its action on the pigment-cells is chemical also; and when we come to study what happens in our own eyes when the light strikes the curtain at the back of them, we shall find that what happens there is very like the action of light when it takes the color out of a curtain or a dress.

What happens next in the history of the eye is that the pigment-cells, which were at first scattered about the surface of the body, are now specially collected in certain places. These cells are not quite on the surface of the skin, but are underneath the outer skin, and the next stage is that, at the place where the pigment-cells are gathered together, the outer skin, or epidermis, becomes thickened, and bulges a little. Now, this is very important, because if we have a bulging, that is to say, a curved surface, through which the light must pass on its way to the pigment-cells, we have indeed a lens of the shape called *convex*, and, as we know in the case of the burning-glass or the lenses of leaves, the result is that the light is focused.

THE SIMPLEST KIND OF EYE, AND THE WONDERFUL EYE OF A FLY

Now, we have already learned enough to be sure that these pigment-cells, like every other part of the body, are connected by nerves with the brain. So now we have reached the stage where there is a lens to focus the light, sensitive cells to be chemically affected when the light falls upon them, and nerves that somehow convey a record of these changes to the brain, which therefore sees. Here, then, is a simple kind of eye, complete from the surface to the centre.

All the eyes of animals that have no backbone are to be looked upon as simply improved patterns of this kind. The eye in such creatures is always developed from the skin in the case of each individual, just as we have learned that, in the history of these animal forms, the eye has gradually become developed from the skin. We shall soon see that the eyes of backboned animals are of a much higher type; but we must not underrate all the eyes below backboned animals, because it is very certain that the eyes of some insects are exceedingly keen. It is generally agreed that the dragon-fly is the most wonderful insect of all in this

respect. Its eyes are extremely large and powerful. As in many other cases, the lens of the eye, instead of being just curved in one single simple bulge, so to speak, is like a large diamond that has had its face cut into a number of little flat surfaces. These little faces of the lens are usually called *facets*. The number of facets upon the lens of the eye of the dragon-fly has been counted to be as high as 17,000!

HOW THE DRAGON-FLY AMUSES ITSELF BY MAKING FUN OF MEN

Few things are more wonderful than the certainty and skill with which the dragon-fly will recognize, follow, and catch the smallest insect on the wing. Professor Forel, one of the many wise men who have made Switzerland famous, and one of the greatest students of this subject, wrote as follows: "By trying to catch them at the edge of a large pond, one can easily convince oneself that dragon-flies amuse themselves by making sport of the hunter; they will always allow one to approach just near enough to miss catching them.

"It can be seen to what degree they are able to measure the distance and reach of their enemy. It is an absolute fact that dragon-flies—unless it is cold or in the evening—always manage to fly at just that distance at which the student cannot touch them; and they see perfectly well whether one is armed with a net or has nothing but his hands. One might even say that they measure the length of the handle of the net, for the possession of a long handle is no advantage. They fly just out of reach of the instrument, whatever trouble one may give oneself by hiding it from them and suddenly lunging as they fly off."

We must not suppose that all insects have good eyes; there are all stages between the dragon-fly, at one extreme, and insects which are completely blind, as, for instance, the cave-dwelling insects and certain kinds of ants.

THE HOUSE-FLY THAT HAS LEARNED TO KEEP AWAY FROM THE GAS-FLAME

The rule for most insects is that they fly towards the light. Artificial lights, such as we use, do not occur in Nature, and an insect flying towards a lamp really supposes that it is flying towards the light of day. It is most unfortunate, from our point of view, that a good many domestic insects have learned in the course of many years to know what artificial light is. We cannot now enter into the very difficult question how it is that this change has been brought about in their natural habits; but, at any rate, it is the case that such an insect as the ordinary fly—as we know it now—does not destroy itself by flying against a flame, and so is able to live freely in our houses.

The habits of flies are extremely dirty; their feet are always laden with filth. They are thus great carriers of disease, and destroy many babies every year, by poisoning their food. That is why it is very unfortunate that flies have learned how to behave to artificial light in what, for their ancestors, would have been an unnatural way.

Many years ago Lord Avebury showed that bees and wasps were able to distinguish colors; but wasps are very inferior to bees in this respect. Bees distinguish all colors, and very rarely make any mistake except between blue and green. The importance of this is very great, because it largely helps to explain how it is that bees are able to distinguish one flower from another.

INSECTS THAT CAN SEE WHAT OUR EYES CANNOT SEE

As a rule, the color of a flower is a kind of flag held out to say to a bee or other insect: "Come here; I have something that you will like." So the bee gets its honey and the flower is fertilized. Thus we owe the pleasure our eyes get from most of the beautiful flowers we know to the fact that the eyes of bees and other insects are able to see them and to distinguish them. If there were no insects there would be no beautiful flowers; there would be nothing for the plant to hang out its flag for.

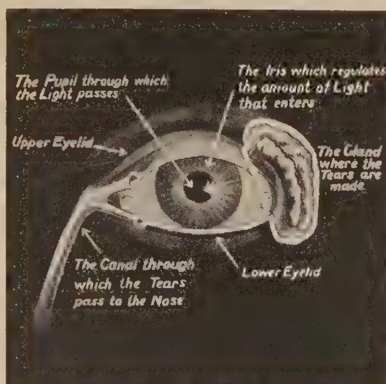
It was also proved by Lord Avebury, years ago, that ants, for instance, can see kinds of light to which our eyes are blind—that is to say, the light which lies beyond the violet, and which is known as *ultra-violet* light.

Here we may notice, what has recently been shown, that people's eyes vary in this respect. Just as old people do not hear high-pitched sounds, which younger people can hear, so we find that there are a good many young people who, something like ants, can see a short way, so to speak, into the ultra-violet, where, to the rest of us, it is quite dark. Finally, Lord Avebury has shown that ants are

able to recognize each other after more than a year of separation. Let us beware of judging the value and power of things by their size, and let us learn from this brief account of one of the senses of insects that we still have reason to go to the ant to "consider her ways and be wise."

Now we must pass to the eyes of backboned animals. The lowest kinds of backboned animals are the fishes, and we have all seen the eyes of fishes. Wonderful and skilful as the eyes of insects may be, the eyes of backboned animals are of a much finer and more wonderful type. In the first place this seems to depend upon a change in the making of the eye. We have seen that the eyes of all the animals that have not backbones are entirely formed from the skin; but the higher type of eye found in backboned animals has its most important parts developed from the brain and not from the skin at all.

True, the front part of such eyes as our own is formed from the skin, but that is only true of the parts through which the light travels on its way to the all-important curtain which makes the back of the eye. That curtain is really a part of the brain which has been pushed out, as it were, from the brain upon a kind of stalk or stem.



The left eye, showing the glands where the tears are made and the ducts through which they are carried to the nose after washing the eyeball. In weeping, the tears cannot all pass through the ducts, and so overflow.

The real reason why the curtain, or retina, of the eye of backboned animals has its great powers—vastly superior to those of any lower type of eye—is that this retina is, indeed, a part of the brain itself. Vision is so important that the brain, so to speak, could not leave the business of receiving the light-rays to anything developed from the skin, but decided to send out a portion of itself, so that the work should be done as well as possible.

In main principles, the eye of backboned animals is much the same, no matter which particular animal we take. The eye of the fish is certainly very much inferior to that of a bird or a mammal, as we should expect, if we consider that the fish has to see only in water, where it would be impossible for any kind of eye to see more than very short distances; but even the eye of the fish is, in all the main points, the same as our own, though much simpler.

We need not discuss specially the eyes of birds, though everyone knows that they have some powers superior to those of the eyes of any other creature. These powers are in the direction of keenness, so that we say of anyone who is very sharp to see things that he has the eyes of a hawk. This keenness is at its best in the case of the hawk and other birds of prey, but other birds also have very keen eyes. They could not catch flying insects if they had not. In praising the eye and the keenness of vision in birds, and in studying their eyes, we must not make the mistake, which is commonly made by almost everyone who has studied this subject and written upon it, of supposing that mere keenness of vision is everything.

It is easy to see what a mistake that is, if we consider the case of a sailor, for instance, who has very keen eyes indeed, and can see far into a fog, but who would perhaps never cast a second glance upon the most noble picture that was ever painted, or upon the most lovely landscape. On the other hand, a great artist may be old and very nearly blind, and though his vision is very dim, yet he can see in a sunset or in a picture things which mere keenness of vision, whether in a man or a hawk, could never see at all. This is worth remembering for it is just as true of all the other senses as it is of vision.

Keenness of sense is very good in its way, and well worth having, but it is one thing to have sharp eyes or sharp ears, and another to have eyes or ears, perhaps not at all sharp, which can see and appreciate the really beautiful and lovely. If we remember this, we shall be very far from agreeing with those

who say that the eyes of birds of prey or of the dragon-fly or of the tiger, or of certain of the lower races of men, are better and finer eyes than our own; they are nothing of the kind.

We are entitled to say they are not because we know that keenness is not the highest quality of a sense, and the best proof of the rightness of our view is to be found in the fact that, when we test the matter by the brain, we find that the vision area is largest and most highly developed, not in the insect or the bird, or in the men with the keenest eyes, but in the brains of the highest type of men, who have learned to see and love what is beautiful and poetic.

THE EYELID THAT WASHES THE EYE-BALL AND KEEPS IT MOIST

And now we are prepared to look at our own eyes and see how they are made. It is right just to mention the eyelids, because they exist for the sake of the eyes, and the eye cannot get on without them. We are very wrong if we suppose that the eyelids merely exist in order to cut off the light when we do not wish to see. They have that purpose, but if we had to do without them and replace them by an artificial shade, we should soon find that that is not the whole of their use, but that they have another use that is of the greatest service to the eyes.

Every time that we wink—which we do every few seconds without thinking about it—the upper eyelid washes the front of the eyeball by means of a tear which has come from the tear-gland, and has been spread over the inside of the upper eyelid.

The tear-gland lies above the eyeball, a little to its outer side. The tear, after washing and moistening the front of the eyeball, passes through a tiny hole at the inner end of the lower eyelid into the nose, as may be seen in the picture of the eye on page 4263.

WHY WE CRY WHEN WE ARE IN SORROW OR DISTRESS

The reason why we cry when we are distressed seems at first to be that the part of the brain connected with the tear-glands lies very close to the part of the brain which is disturbed when we are made unhappy. It has been pointed out that if the arrangement of the brain were slightly different from what it really is, instead of producing an extra quantity of tears when we were miserable or unhappy, we might produce an extra quantity of saliva.

This very unpoetic suggestion was made by a poet. It has been credited by several students of the subject. The present writer believes, however, that the truth is very much more poetical than that poet suggested. The real reason, we may believe, why we show signs of distress in our eyes rather than anywhere else is that we human beings live by one another's help and sympathy and love. We are meant to see when others are unhappy, so that we may know, beyond any doubt, when they are needing our sympathy and help.

If a child's mouth merely watered when it was unhappy, we should not know, and therefore would not help it; but when we see its eyes water our sympathy is aroused, and we help it. We cry, not because the brain happens to be so made, but the brain has been so made because crying is the most useful and convenient way in which our distress can be shown to others.

HOW THE FACE AND THE EYE EXPRESS OUR FEELINGS

As the higher parts of the brain develop we learn self-control, and cry very much less readily than when we are quite young; but it is still true that our feelings find expression that can be seen by other people, for the face shows our feelings, and when we make a general study of the way in which our feelings are expressed by the various parts of the face, we shall see that crying fits in with these other ways of expression as the watering of the mouth would not, so that it is more than a mere chance that sorrow and sadness find expression in the shedding of tears rather than in the production of saliva or in some other way.

The eyelids are provided with hairs which help to protect the eyes from dust. Besides the protection afforded by the eyelashes, we must reckon with the eyebrows, as they prevent the sweat of the forehead from running into the eye. Lastly, we have to notice the well-contrived bony structure of the skull around the eye, which furnishes a very wonderful protection.

THE NEXT PART OF THIS BEGINS ON PAGE 4329.

Drying Cleaned Sponges in Florida.

THE LIFE OF THE SPONGE

CONTINUED FROM 4246

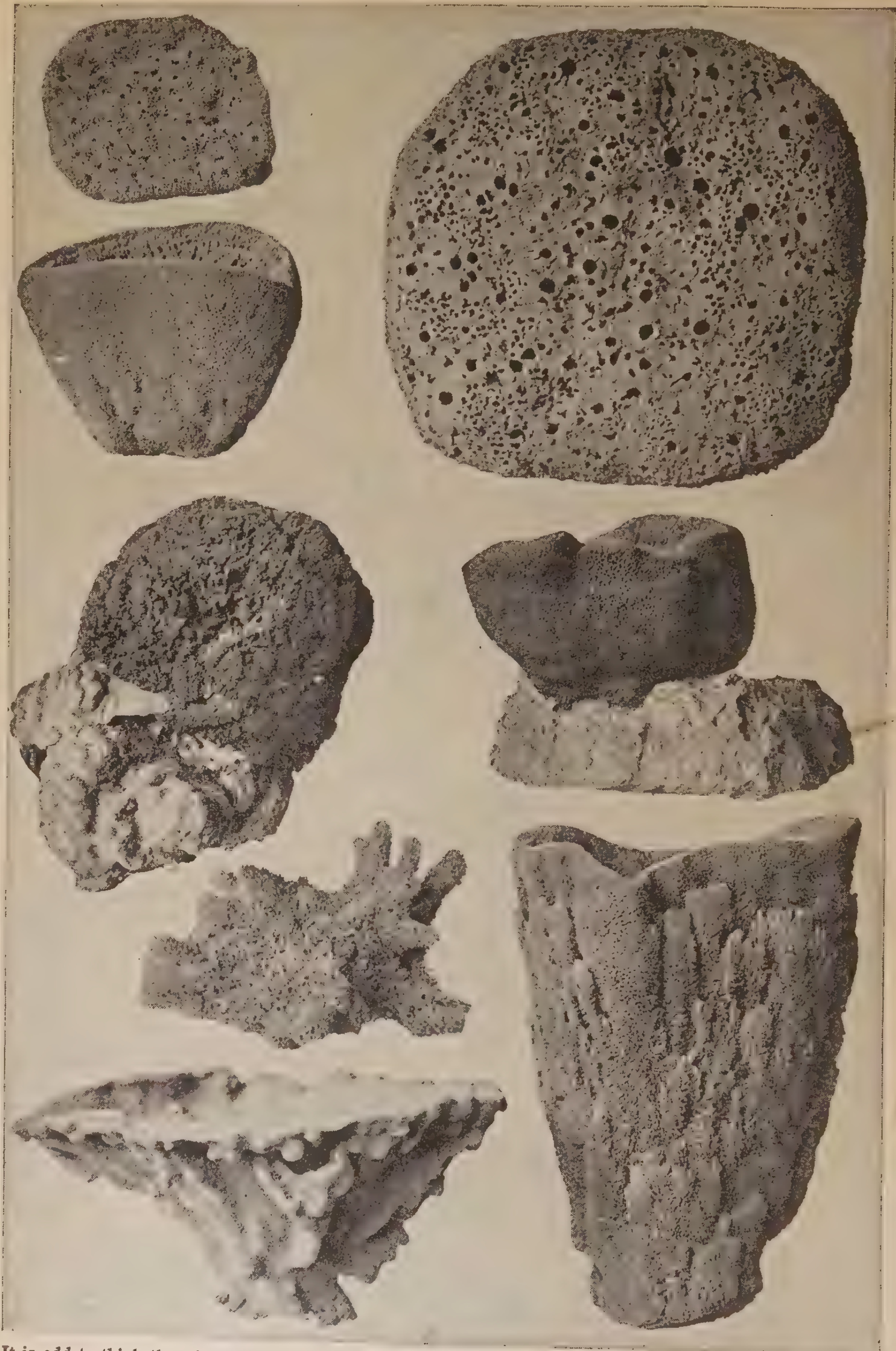
THE Greek and the sponge are closely connected. Long, long ago in the clear rock-sown seas around Greece the young Greek diver toiled to bring up the curious sponge masses; the ancient warriors used sponges to pad their helmets; Greek merchants brought sponges into the London market early in the nineteenth century, and Greek divers, who have learned their art in the Mediterranean, are the chief sponge fishers in the waters of the Gulf of Mexico to-day.

Less than a century ago all the sponges used in this country were imported from the Mediterranean and Red Seas; to-day many of them come from the warm clear waters off Florida, in the Gulf of Mexico, and the West Indies. When they were first found growing off the island of Key West the sponge fishermen used to go out, two in a small boat, to fish for them. The man in the stern sculled the boat, and the one in the bow hooked the sponges. The hooker was armed with a long hook, 45 or 50 feet in length, and with water-glasses, a bucket with a glass bottom tied to the side of the dinghy. Pushing the water-glass beneath the ripples on the surface, the hooker rested on the thwarts facing towards the bow and pushed his head as far down into the bucket as possible. As soon as he sighted a sponge, he dropped the water-glass and grasped his hook with both hands. A little hoist and he landed a fine sponge in the boat. His mate, meanwhile, was sculling very smoothly and gently along, so as not to cause the hooker a strain, or cause him to lose his balance.

To-day, however, most of the sponge fishing is done by expert Greek divers, clad in the most modern diving suits and carrying with them mesh bags in which to collect the gluey, strong-smelling masses. The water in which the diver works is so clear that there is little danger except from sharks, which abound. These he cannot attack with a knife for the scent of blood would draw others to the spot; all he can do is to remain perfectly still, for the shark will soon leave anything that seems dead. Basket after basketful is drawn up to the boat above and then the sponges are carried to the big ship, where they are spread on deck until the slimy matter has drained out of them. While this dying process is going on, the sponge gives off a very strong, disagreeable odor which gradually lessens till it resembles that from seaweed. When the schooner has made her haul, she returns to her port, and the

Copyright, 1918, by The Grolier Society.

THE LIFE OF A SPONGE



It is odd to think that the sponge we use in the bath was once alive, but so it is. The sponge lives in the sea, and breathes oxygen like a fish. Water is drawn into it through little pores, and the food the water contains is devoured by cells, and the water passes out by the large holes which we see in the sponge. They are really canals, and in them worms and tiny shell-fish, and even small crabs, make their homes.

WHERE THE SPONGES COME FROM

Here is a sponge-fishing fleet being got ready in the harbor of Hydra, Greece, to sail for sponge-fishing. The sponges live in warm, tideless seas off the coasts of Turkey and Greece, off Florida, and off the Bahama Islands and West Indies. They make their homes upon rocks, or on the mud, or even upon other animals.

The fleet has started, and here we get a view of the inside of one of the boats, and of the fishermen.

This is one of the sponge-fishing fleet, sailing before a favorable wind towards the home of the sponges.

This boat has reached the fishing-ground, and a diver is going down to drag up the sponges that lie from 40 to 60 feet below the surface of the water. The tube which we see to the left of the diver will send down fresh air for him to breathe. He will uncoil the rope in his hand so that it may serve as a guide to him in the water, and by jerking the rope he can signal to his comrades to pull him up with his sponges.

THE SPONGE-DIVERS AT WORK IN THE SEA

Here we see the boats on the sea, and the divers in the water, stripping the sponges from the rocks. The men who wear diving-dress can stay under water for hours. The man who is diving from the boat on the left has no diving-dress. He will not be able to stay in the water more than two or three minutes.

Here the sponges are being roughly cleaned after being brought ashore by the boats. There is a thin skin overthe sponge, and in all the pores and canals is a slimy, sticky substance, which is the life-matter of the sponge. The skin has to be removed, and the sticky substance squeezed out to fit the sponges for sale.

This is a scene in Florida, to which a sponge-fishing fleet has returned. The sponge-fishers build wooden enclosures in the water, which we see here, so that in them they may store their newly-caught sponges. The action of the water makes it easier for the fishermen to remove the slime and skin of the sponges.

sponges are put in kraals like those shown in the picture—in order that the tide may wash them out thoroughly. After a week in the kraals each sponge is taken separately, and squeezed, and beaten with a stick till all the living matter has disappeared. Finally, it has to be bleached, and, according to its kind, this is differently done. The fine sheepswool variety is washed in very soapy water, and hung in the air and sun and dew, covered with soapsuds. The more common yellow sponge is bleached with a solution of lime, or an acid and sea water, although acid sometimes weakens the fibre of the sponge.

Though most of the sponges used in America come from the waters around Florida or the West Indies, the finest quality comes from the Mediterranean and the Red Seas, where sponges have been gathered from the same waters for many centuries. The sponges of the Western World are generally coarser than those of the East. Though sponges are not used so much in surgery or in the bath as in former times, new uses have been discovered, and the demand continues heavy.

The beds of sponges are rapidly becoming depleted because they are constantly fished, without allowing time for the young sponges to mature. Because of this the United States government has passed laws forbidding divers to take sponges between the 1st of May and the 1st of October. Revenue cutters have authority to seize boats engaged in fishing during this close season. Further, the cultivation of sponges is being seriously considered, although as yet the process for growing them costs too much for commercial purposes.

Bits are cut from a live sponge, and each of these is fastened to a sort of base, usually made of cement. This is sunk into shallow water, and the sponge may grow so rapidly that it may be taken up the next year, or in two years at most. Some of the sponges die, however, and some of the bases are lost, so that the expense is large and not many sponges are yet grown in this way. Some day we may have to depend upon this method if the public waters are fished so constantly. Perhaps some kinds of sponges may be reared from their eggs.

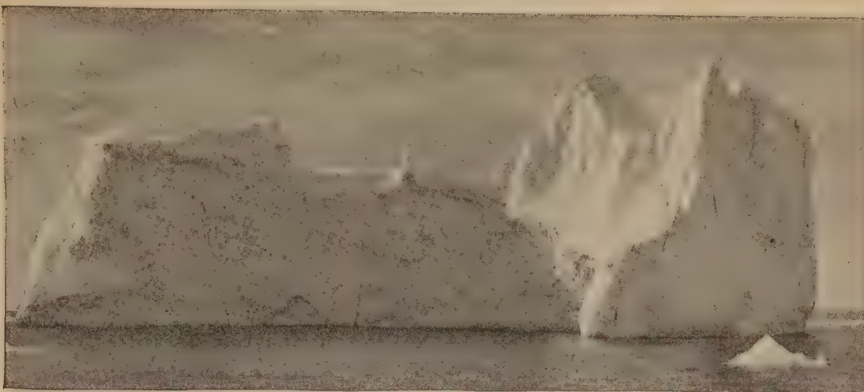
Here are the sponges brought in from the fishing-ground at sea by the two boats on the left and right of the picture. They are big, good sponges, which have been gathered by hand from the depths of the sea. Some divers tear the sponges away with pronged forks, but this spoils them, and reduces the price.

The photographs in these pages are supplied by Messrs. Cresswell Brothers & Schmidt, London.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4453.

MOUNTAINS OF ICE FLOATING IN THE SEA

Here we see some of the fantastic forms taken by the great icebergs that float down from the north into the Atlantic and Pacific Oceans. Icebergs have the appearance of dazzling chalk cliffs. Their height above water is sometimes 250 feet, which means that under water they reach to a depth of more than 2,000 feet. Icebergs often carry to sea boulders and piles of smaller stones, and even Polar bears are sometimes seen making a dangerous voyage on an iceberg. When the ice melts they sink in the sea and are drowned.



WHY DOES AN ICEBERG FLOAT?

CONTINUED FROM 4117

If we were to judge by almost every other case we know, we should say that an iceberg must certainly sink. The rule is that when anything is cooled it becomes denser—that is to say, heavier in proportion to its size. In other words, it contracts. If this were true of water, ice would have to sink, and our earth would not be the earth we know.

Water certainly contracts as we cool it down to four degrees centigrade above the freezing-point. But from this point downwards water expands instead of contracting, so that ice is slightly lighter than the water around it. The difference is not very great—it is just enough to allow an iceberg to float with about seven-eighths of itself below the surface of the water and one-eighth above it.

In the Antarctic Ocean one may see icebergs that are actually miles across, and they may rise two or three hundred feet above the surface of the water. But the laws that govern floating must always be obeyed; and if we remember that there must be seven times as much ice below the surface as shows above it, we shall get an idea of the enormous size that masses of ice sometimes attain. The part below the surface is, of course, surrounded by liquid water, which is warmer than the ice. Consequently, by the laws of heat, there must be a flow of heat from the water to the ice, which therefore melts. The result often is that, after a time, owing to the destruction of the foundations, so to speak, the iceberg capsizes, and a new part of itself shows above the surface.

It has been lately proved that when ice is made very cold indeed, a point is reached when it begins to behave as other things do, and shrinks as it cools. But, fortunately, this point is far below any temperature that occurs naturally on our earth, and so it is not so important.

HOW DO FISH LIVE IN A FROZEN POND?

Ordinary ice, we know, is lighter than water, and therefore it floats. So what we call a frozen pond is a pond of which the surface is frozen. Skaters are perfectly aware of this. They want to know how thick the ice is, for they know that there is liquid water underneath it. So when we speak about fish living in a frozen pond, we mean fish living in liquid water that has a layer of frozen water above it.

The really serious part of this for the fish is not, as we might think, the coldness of the water in which they are, but the question how that water is to be supplied with enough air to enable

the fish to live. When a pond is not frozen, oxygen from the air above it is passing into the surface of the water as fast as it is being used up by the fish and other living creatures in the water.

When a pond is frozen, this process is very nearly stopped. There may be gaps in the ice here and there—air-holes, such as air-breathing creatures will make in the frozen North—but perhaps there may be none of these. A little oxygen may get through at the edge of the ice, but the best hope for the fish is that there is a supply of new water coming into the pond below the ice from somewhere else, and bringing enough oxygen dissolved in it to keep the fish alive. If the supply of oxygen is kept up in none of these ways, then, when there is no more of it left, the fish will surely die, as must every living creature that is prevented from breathing, whether it be man, mammal, bird, reptile, fish, moss, or microbe.

HAVE FISHES ANY FEELING?

Certainly they have. Everything that lives, from a microbe up to a man, has some kind of feeling. The power to feel and to respond to what is felt is a mark of all living matter everywhere, and its disappearance without return is the mark of death. But the amount and the quality and the clearness of feeling differ widely in various living things. So it would be equally wrong to say that a fish has no feeling, and to say that it feels as we do. It does feel, but it does not feel as we do.

Seeing is a kind of feeling, and perhaps a fish sees quite as well as a young baby does. A fish hears, too, and smells and tastes. Also, a fish certainly has the sense of touch. It can suffer a kind of unpleasant feeling, too, and must do so, for instance, when it has a hook in its mouth; but it would be a great mistake for us to fancy that it feels sharp pain as we should if we had a barbed hook in our mouths.

A fish has only a very simple kind of brain, and cannot feel so keenly as we do. So as to whether it is right to fish, I think we should decide for ourselves, and act accordingly, but not condemn or ridicule people who differ from us in their opinion on the matter.

WHY IS SUGAR SWEET?

This is a question which can be answered *in a way;* and yet cannot be really answered at all. We know that there is a certain well-marked part of the surface of the brain which is the real seat of the sense of taste. From, or to, this place there run at least four, perhaps more, sets of nerves, which at their other ends we find in the "taste bulbs" of the tongue and part of the throat. One set of these nerves, when it is excited, arouses in the brain the feeling which we call a sweet taste, and the thing which specially excites this particular set of nerves is sugar. So, *in a way*, that is the answer to the question.

But no one has the least idea why sugar should not taste salt, or why salt should not taste sweet or bitter; nor is there any imaginable way of describing a sweet, a salt, or bitter, or acid taste to anyone who does not know these tastes. We cannot even know that other people taste sugar or anything else just as we do.

"Sugar" is really a name for a closely related group of chemical substances, all of which are sweet tasting, though some are less so than others—for instance, milk sugar. But saccharin, which some people use instead of sugar, is utterly different from sugar chemically, yet it is sweeter than any sugar.

WHY DOES HOT WATER CLEAN THINGS BETTER THAN COLD?

When things are dirty, especially our skin, or our clothes, or the plates we have eaten from, the chief cause of the dirt, and the chief difficulty in getting things clean, is fat or oil. If we try to clean an oily plate with cold water, we cannot doubt this. Fat and oil are great catchers of dirt, and if we wash our fingers perfectly clean, and then rub a little butter on one hand, but not on the other, five minutes will show a great difference between the two hands.

Fat is simply solid oil, and oil is liquid fat. Whether the thing shall be solid or liquid is decided by the amount of heat in it. If it is hot, it is liquid, and then it can easily be got rid of. Hot water turns solid fat and half-solid fat into a liquid oil, and that is the reason why it cleans things better than cold water.

If the thing we have to clean has no fat or oil in it, we shall find that whether we use hot or cold water matters very little. But the mere fact that we commonly use our bare hands for washing things makes hot water more useful,

as our hands themselves are producing a quantity of fat or oil all the time except when they are bitterly cold.

WHY CANNOT ORDINARY GLASS BE BENT?

All we can say is that different kinds of matter have different properties; some matters will bend, or be hammered into thin sheets, or be drawn into long wires without breaking, while others will not. The differences depend on the way in which the molecules of the thing in question are joined to each other. Glass is one of the things that are rigid and brittle, while clay, for instance, can be bent or molded into any shape.

But it is very interesting to find that the same thing may sometimes be brittle and sometimes plastic, according to circumstances, and the most important of these circumstances is the temperature. Glass itself gives us an instance of this. It is quite true that glass, as we know it, will not bend—or, rather, that it will not bend much.

If we make the glass hot—red hot, or a little less than red hot—it will bend quite readily into any shape we please. Then we can cut it with scissors, or draw it out with pincers, or mold it into any shape we like. This is the general rule with a great many things which are rigid and brittle when they are cold. It must mean, of course, that when the glass is made very hot, its molecules do not hold on to each other so tightly as they do when they are cold.

WHY DOES THE STREAM RUN MOST SWIFTLY IN THE MIDDLE?

The water at the side of the stream is constantly being held back by rubbing against the banks, just as the bottom of a wave is held back when it reaches the shallow water near the shore. And so, compared with the water near the sides, the water in the middle of the stream runs more swiftly. It is held back a little by rubbing, or friction, between it and the slower moving water at the sides; but the friction between water and water is very much less than the friction between water and anything that is solid, such as the banks of a stream.

When we watch the blood running in a blood-vessel, we see exactly the same thing. In the middle of the stream we see the tiny red and white cells tumbling fast over each other as they scurry along. But near the walls of the blood-vessel they move much more slowly, for they are held back by the friction of the wall, even though it is beautifully smooth. And just the same thing happens with smoke going up a chimney, and in many other cases. We should always try to think, when studying such a question as this, of other cases where the same principle of friction is really at work.

WHY DOES BOILING MILK FLOW OVER THE TOP OF THE SAUCEPAN?

When any liquid boils, what happens is that parts of it are changed into a hot gas. This is much lighter than the liquid in which it is formed, and so it rises to the top as a bubble, and there the bubble bursts and the gas is given off into the air. When a bubble formed at the bottom rises through the liquid unbroken until it reaches the top, and bursts there, we say that the liquid is boiling.

In the case of water, which is all made of one thing, there is nothing to prevent the bubble from reaching the top of the boiling water and bursting there. So, though the surface is raised everywhere for a moment by bubbles which have half freed themselves, the water does not boil over. But milk is a mixture of a great many different things, some of which can boil, and some cannot. What really boils in milk is the water, which, after all, makes up the greater part of it.

At least one of the things in the milk turns solid and forms a skin on the top of the milk when it is heated. This skin is made of one of the valuable proteids of the milk, and it is great waste not to eat it. Now, when the bubbles of water-gas reach the surface, they find themselves imprisoned by this solid skin that is forming, and they lift it up, just as the hot air may lift a toy balloon, so that, as we say, the milk boils over. If we carefully stir it, we may prevent this.

IS A FLY, IN COMPARISON WITH A MAN, REALLY THE STRONGER OF THE TWO?

Everyone will know what this question means, and yet it is not quite rightly put. So far as the words go, the question might mean, if you compare a fly and a man, which is the stronger? But we know that what the question really means is this: "Is a fly really stronger than a man relatively to its size, or in proportion to its size?" The answer is certainly yes. The last thing in the world that distinguishes

man is bodily strength of the kind which is shown in lifting weights, and so forth. It is by *skill*, made not by the muscles, but by the brain, that man lives on the earth—skill, not strength. If we weigh the proportion of the bodies of different animals that is made of muscle, and if also we weigh the proportion that is made of brain, then we learn how muscle has been getting less and less important, while brain, with all that brain means, has been getting more important. Not only a fly, but animals in general are the superiors of man so far as muscular strength is concerned; but then the question of muscular strength is an inferior one, and man is master because of what really matters, which is mind. The race is not to the swift, nor the battle to the strong, but to the wise, who will use their brains.

WHAT MAKES THE WHITE MARKS ON OUR NAILS?

Our nails are made of a very special kind of horny material. It is in some ways like the material that makes the outer skin; it is also still more like part of the material that makes the hair; but it is different from either of these, and comes closer to horn than any other part of our body does. It is made by special cells of the deeper part of the skin at the base of the nail, and our nails, therefore, depend entirely upon the perfect health of these cells.

In cases where a person's skin is not in health, it is very commonly found that the nails suffer, dropping out or becoming cracked or brittle; and if for any reason the blood is out of order, and so supplies what is not quite suitable, or may even be poisonous, to the cells at the base of the nail, their work will be interfered with, and though they may go on producing nail stuff, it will not be quite what it ought to be.

In this way we can often see white marks across the nails, sometimes on all the fingers of both hands, corresponding to the date when we were out of health, and when the proper nail substance could not be made. The toenails may also show indications of these white marks, as we should expect.

WHAT IS AT THE END OF SPACE?

It is not often that we can answer a question about the outside world by looking into our own minds and seeing what they tell us. Indeed, for many ages the progress of knowledge was stopped because men thought they could discover things out of their heads instead of looking to see what Nature said. But this is a question which we can answer out of our heads; we do not need to go to the end of space to answer it. We find, directly we begin to think of the end of space, that there must be more space beyond it. It is impossible for our minds to think of the end of space. Directly we try to do so we are bound to think of more space beyond it. There is no way out of it. In the same way, we cannot think of the beginning nor yet of the end of time. However far back we like to go in our minds, there must have been a time before that, whatever it was; and so, if the world came to an end, as we say, there would still be the time after that event happened. We are bound, by the very nature of our minds, to think of space as infinite, and of time as infinite, too. *Finis* is Latin for end, and infinite literally means unending.

WHY DO WE GET A HEADACHE IN A CROWDED ROOM?

We do not get a headache in a crowded room if it is properly ventilated; only, of course, it never is, and if any one of us is the only person in the room, a headache will very likely come on if the room is small and shut up so that the air cannot be changed. There is no question that it is the foul air which causes the headache. The reason why the crowding of people together has this effect is that it is the people themselves who make the air foul.

Every living thing, without exception, gives off to its surroundings, in one form or another, products of its life which are worse than useless to it, and which it must get rid of. The most elegant people, spotlessly clean and perfumed, are no exceptions to the rule. There is a good deal of doubt as to what precisely the things are which produce the effects of foul air. It is possible that gases given off from the skin, especially if it is not very clean, may contribute.

The chief external causes of headache in a crowded room are excessive heat and moisture, acting together, for either alone does not seem to affect us to any great extent. Heat and moisture interfere with the normal or proper action

of the skin. The active purpose of our skin is to keep the temperature of the body within certain limits by the evaporation of moisture from the skin. If this is stopped the temperature of the body rises, and the skin makes an effort to throw off water by increasing the flow of blood to the skin. In so doing it draws away the supply of blood which should go to the brain and other organs. These are so much disturbed by the action of the skin, that there can be no doubt that the headache is caused by these disturbed organs.

WHY DOES THE HAIR STAND ON END WITH FRIGHT?

We know that both in ourselves and in many of the lower animals the hair can, and does, stand on end with fright, almost "like quills upon the fretful porcupine," as Shakespeare says. It is also true, as he says, that it is possible for "each particular hair to stand on end," for we find that every hair has the power to do this, and that what happens is not that several hairs stand up together as the result of pulling on the skin. At the root of the hair we find a tiny muscle so arranged that, while the hair usually lies slantwise, when this muscle pulls, the hair stands upright.

The best reasons we can give for this peculiarity are that this movement may help to keep the root of the hair in order by a sort of massage, or that it may serve in keeping the skin clean, or, most likely of all, that it may make such an animal as a cat, when its hair is standing on end, look very much bigger and more terrible to an enemy.

WHY DO WE FEAR BEETLES OR SPIDERS WHEN WE KNOW THEY CAN NOT HARM US?

This is one of the most interesting of questions, because the answer to it takes us right into the depths of the mind. What we call reason, or intelligence, is in many ways the highest part of the mind, but it is not the whole of it. It is, in a sense, a new thing, and its power is limited by the fact that there are other parts of the mind, far more ancient, which have to be reckoned with as well. Most of these we may simply call instincts, and again and again we find, when we observe ourselves and other people, that the instinct of curiosity or of flight decides our actions quite apart from our reason, and quite apart from what we know, or do not know, in the particular case. Very often indeed the part of us that knows does little more than just sit still, so to speak, and look on and notice what the rest does. If we think, we shall see that we could not live if we had only our reason. To begin with, a baby would not suck, for there would be nothing to make it do so; and so it would be in a hundred ways throughout life.

But often our instincts may mislead us, though usually they guide us rightly, and so we may have the instinct of flight and the feeling of fear, which goes with it, when we see a beetle or a spider; and then we may be able to notice that, whatever the knowing part of us says, there is something else in us, older and stronger, which has its way and makes us afraid. Even now it is highly desirable that we should dislike crawling and creeping things; many may be harmless, but many others are dangerous in various ways; and, on the whole, this instinct is a useful and wise one for us to have.

WHAT MAKES THE POISON IN A SNAKE'S FANG?

A snake's fang is an eye-tooth, or canine tooth, as it is called, corresponding to the sharp pointed teeth that we have at the corners of the jaw between the front teeth and the back teeth. In the case of the poisonous snakes, the tooth has a special channel in it through which the poison can run when the snake bites. The snake, like ourselves, has certain glands, but in our case these simply produce the saliva, which helps us to chew and digest our food.

In the snake, however, these glands do much more that that, and especially the gland which corresponds to the one we have in front of the ear, the one which becomes so swollen and painful if we have mumps. In the snake the business of this gland is to produce poison. The poison runs along a little tube from the glands on each side of the mouth to the poison teeth. When the snake bites, the muscles of the jaw, which make the teeth meet, also squeeze upon the glands in these tubes in such a way that a little of the poison is forced through the channel in the fang, and left in the victim's body. The amount of poison

thus injected is, as a rule, exceedingly tiny, but the venom, or poison, of many of the venomous snakes is among the most deadly of all poisons, and a tiny portion of a drop will kill. This is a deeply interesting question from the widest point of view, because it is so remarkable to discover that, in certain kinds of animals, parts of the body which are possessed by so many other kinds of animals, and which were certainly evolved for one purpose in the first place, are turned to a quite new and special purpose in these particular cases. In non-poisonous snakes, these same glands, which are so poisonous in the venomous snake, look just the same, yet produce nothing to hurt anyone.

HOW DID ALL THE METALS GET INTO THE EARTH?

If this question had been asked some years ago, no one could have made any better answer than that the various metals were in the stuff from which our earth was formed ages ago, and that by some chance or other they just settled down in the earth's crust—one here and one there. But quite lately we have had to give up for ever ideas of this kind.

We are beginning to understand that change is going on everywhere. This is true of worlds; it is true of plants and animals; it is true of nations and their ways; and, for instance, it is true even of the atoms of the elements. So now, when we find gold in some part of the earth's crust, or silver, or lead, or whatever it be, instead of saying that these were always there, we inquire into their history and find out how they came to be made, just as if we were studying the remains of some animal or plant.

For instance, we have little doubt that all the lead in the world is the result of a long series of changes that began in an element called uranium, and that stages in between uranium and lead are represented by the element called radium and the beautiful and precious metal which we call silver. It may not be very long before chemists are able to work out the history of many metals, and even to discover what will happen to them next.

WHEN WE DIVE WHY DO WE ALWAYS RISE TO THE SURFACE?

This is not a very easy question to answer. For one thing, it is possible to dive and not rise again. This may very easily happen when a man dives from a height into shallow water, and does not do the right thing when he gets under. He may then strike the mud at the bottom and stay there. That is the danger of diving from too great a height into shallow water. In such a case the diver's body would naturally go deeper than the water before it came up again. The secret of his success is that he turns his hands after he enters the water, and so changes his course.

Apart from this, the reason why the diver comes up again is to be found partly in the action of his arms and legs under the influence of the powerful instinct to get to the air again, and partly in the elastic rebound of the water after he has struck it. We must also remember that the pressure of the water becomes greater with every descending foot; and the diver's body, filled as his lungs are with air, is scarcely, if at all, heavier than the water itself.

The case at once becomes different if he is injured, or if he is a drowning person unaccustomed to water, who breathes out into the water the air of his lungs, and then breathes water in. That is quite as bad as letting water get into the air-tight compartments of a boat.

DOES A TADPOLE KNOW IT WILL LOSE ITS TAIL?

Certainly we cannot speak of a tadpole, or any such creature, knowing anything in any such way as this question suggests. A tadpole, a fish, an insect may know, in the sense of recognizing, a thing that it has seen before, and remember whether it is nice or nasty. A dog, an animal of very high intelligence compared with a tadpole, may know when its master is angry; may know when it is doing a thing which is disapproved of. But not even a dog can ever *know* in the sense suggested by this question.

Let us consider what the point is. If a tadpole is to know that it will lose its tail, this means that it has arrived at the idea of itself as I, and that it is able to think of itself in the future and what will happen to it. In other words, the tadpole must be conscious of itself. But this consciousness of ourselves, or self-consciousness, is found in no living creature but man, and is, beyond all other things put together, the fact which distinguishes man from every other form of life on the earth.

Even a human baby does not have self-consciousness. Tennyson has said:

> The baby new to earth and sky
> . . . .
> Hath never thought that this is I.

When a baby learns to talk, it first speaks of itself as baby, and only gradually discovers itself, and speaks of I. Then it has become really human. If a tadpole knew that it would lose its tail, the power to do that would at once place it on a level with ourselves; it would be no tadpole.

WHAT MAKES THE CATERPILLAR TURN INTO A BUTTERFLY?

Whenever we ask about any fact of a living thing, we have to make our choice and balance more or less between the effects of its own nature and the effects that its surroundings work upon it. In the case of this question, everyone will agree that the important thing is the nature of the caterpillar.

By altering its surroundings as regards temperature, light, moisture, and so on we can hasten, or retard, or slightly affect in other ways, the change that occurs to the caterpillar. But such experiments as this only make it more clear that the real cause of what happens is to be found in the nature of the caterpillar itself. Now, if we look at a caterpillar and do not think of what it will become, we shall agree that it is in most respects a sort of worm. On the other hand, if we look at the butterfly and forget what it was, we shall agree that it is a sort of insect.

There is a vast difference between a crawling worm and a flying insect. Now, if we look at a tadpole, we shall agree that it is a kind of fish, breathing the air dissolved in water, like other fishes; but a frog is no fish, and breathes air as we do. The explanation, we believe, is that the frog, and all creatures like frogs, are descended from fishes, and so in its earliest stages each of them is a fish. So also we are bound to believe that the insects are descended from the worms, and that is why the caterpillar turns into a butterfly. In a large book it might perhaps be possible to begin to do justice to this question.

WHY IS IT DARKEST JUST BEFORE DAWN?

We ought to begin by asking: Is it darkest just before dawn? There is probably very little ground for this belief. At any rate, we may be quite certain that in all cases like this, where we compare darkness and light, or loudness and softness, it does not do to trust to the evidence of our senses, because they do not judge fairly.

There are various ways by which we can measure the brightness of light. In order to prove that it was darkest just before dawn, it would be necessary to use some kind of light measurer—not our eyes—and compare the amount of light it recorded just before dawn with what it recorded previously. Our eyes and sense in general do not judge things on their own merits, but always by comparison with other things.

The proper way to say this is that all our sensations are relative. A room may be light relatively to a room that is less light. If we go to the room from darkness we call it bright; if we go to the room from blazing sunlight we call it dark. And so we judge the darkness before dawn by the dawn. When the light begins to come into the sky, we think how very dark it was just before.

WHY ARE THE NAMES OF CHEMICALS AND PLANTS WRITTEN IN LATIN?

Latin is now what we call a dead language—that is to say, no living nation speaks Latin, though, in point of fact, one-third of English, for instance, is really Latin. The time was, of course, when Latin was a living language, spoken by the most important people on the face of the earth at that time. They had names for many chemicals and plants, many of which names we use to-day.

But long after the downfall of Rome, Latin remained the language of scholars; it was the one language known to all learned men all over the civilized world; they always wrote their books in it, and lectures were always delivered in Latin. It was thus possible for an Italian, shall we say, to visit England and lecture to the Englishmen at Oxford in a language which was neither his own nor theirs, but the common tongue of the learned.

So it naturally came about that when the great Swede Linné, usually known by the Latinized form of his name, Linnæus, began to name and classify plants, he gave them Latin names. The convenience of Latin for such purposes is as great now as ever it was.

THE NEXT QUESTIONS ARE ON PAGE 4369.

THE WOLF CAME BACK AGAIN TO THE HOUSE

"Dear me, how late you are!" said the pig when he saw the wolf. "I've been back an hour or more. I'm sure I'm much obliged to you; they were fine turnips!" The wolf was furious, but pretended not to mind.

THE THREE LITTLE PIGS

CONTINUED FROM 4240

ONCE upon a time, three little pigs went out into the world to seek their fortunes. The first little pig had not gone far before he met a man who was carrying a bundle of straw.

"If you please," said the little pig, "will you give me some of that straw to make me a house?"

"With pleasure," replied the man, and away went the little pig with the straw, and built his house.

Now, an artful old wolf who lived near by determined to have the little pig for supper. So when it became dusk he went up to the little straw house and called out:

"Little pig, little pig, may I come in?"

But the little pig knew his voice, and said:

"No, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf. "Then I'll puff and I'll blow till I blow your house in."

And he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the little pig, and gobbled him all up.

The second little pig met a man carrying some sticks.

"If you please," said the little pig, "will you give me some of those sticks to make me a house?"

"With pleasure," replied the man. Away went the little pig with the sticks, and built himself a cosy house.

That night the wolf came to the door.

"Little pig, little pig," cried the wolf, "may I come in?"

"No, no," replied this little pig, as the other one had done; "no, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf in a rage. "Then I'll puff and I'll blow till I blow your house in."

And he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the poor little pig, and gobbled him all up.

But the third little pig was exceedingly wide awake the morning *he* set out on his travels. This little pig went on till he saw a man carrying bricks.

"If you please," said the little pig, "will you give me some of those bricks to make me a house?"

"With pleasure," replied the man, and away went the little pig with the bricks, and built his house.

Soon the old wolf came along that way, and knocked at the door.

"Little pig, little pig, may I come in?" he cried.

"No, no," cried the little pig; "no, no; by the hair on my chinny, chin, chin!"

"Then I'll puff and I'll blow till I blow your house in!"

But the house was made of bricks, and the old wolf he puffed and he

blew, and he puffed and he blew, and still the house stood firm. At last he went away in a rage; but presently he came back again.

"Little pig, little pig, I know a field just down the lane where there are such fine turnips. I'll call for you in the morning and show you the way."

The next morning when the wolf called out: "Are you ready, little pig?" the little pig replied: "Dear me, how late you are! I've been back an hour or more. I'm sure I'm much obliged to you; they are fine turnips!"

The wolf was furious; but, pretending he did not mind, he said, quite pleasantly:

"Do you like apples? I know an orchard down the lane where the trees are covered with fruit. I'll call for you in the morning, and show you the way."

The next morning the wolf got up very early, and walked round to the little pig's house. But the little pig must have got up earlier still, for when the wolf arrived he found him out.

The wolf hurried off to the orchard; but the little pig saw him coming, and climbed up into a tree.

"These are indeed fine apples," he called out, as the wolf came up to it. "Just try this one." And he threw the apple as far away as he could into some long grass. Then, while the wolf was hunting for it, the little pig scrambled down the tree, and ran home.

The wolf did not like being beaten, so the next morning he went again to the little pig's house, and said:

"Little pig, little pig, there's going to be a fair on the village green this afternoon. You come along with me, and we'll both have a fine time. I'll call for you at exactly three o'clock."

The little pig said nothing, but at half-past two he started off for the fair. He bought a churn, and was rolling it home when he saw the wolf in the distance. Quick as lightning the little pig jumped into the churn to hide, and set it rolling down the hill. The hill was steep, and the churn came flying along at such a speed that the wolf became frightened, so he turned back and ran home as fast as he could.

Some hours later, when he felt braver, he went to the little pig's house.

"I was just on my way to call for you this afternoon," he shouted out, "when I met the most awful thing rolling down the hill all by itself. It gave me a horrible fright, I assure you. There must have been a witch inside."

The little pig burst out laughing, and he laughed so loud and he laughed so long that the old wolf was annoyed.

"I was the old witch," said the little pig, as soon as he could speak. "I spied you a long way off, and I jumped inside to save my skin."

This so enraged the wolf that he jumped up on to the roof and began sliding down the chimney. But it was baking day, and the little pig had made a huge fire. Down, down, down slid the wolf; there was nothing to save him. He sank right down into the fire, and was burned to cinders. And that was the end of the old wolf.

THE DOG THAT REMEMBERED ODYSSEUS

WE have read some stories about the hero Odysseus, who is sometimes called Ulysses; and this is the story of his dog, whose name was Argus. Before Odysseus went away from his home in Ithaca to the great war with Troy, there was a puppy born, which grew to be a noble hound.

Odysseus loved Argus, and Argus loved his master. The hound would prick up his ears and give a joyful bark when his master approached. Then he would look at Odysseus with a world of love reflected in his eyes, and raise his head for the caress which always followed.

As Argus grew older he seldom left Odysseus for long. Like a shadow, he followed his master everywhere, except upon very long journeys. But before the hound was fully grown, Odysseus went away to the war, which lasted for ten years. And still a long time passed, and Odysseus had many wanderings before he came again to Ithaca. And when he returned, being worn and travel-stained, there was no one who knew him again.

But when he came to the palace, there lay at the gate the ancient hound, Argus, very near death. Yet when the hound looked upon Odysseus, and heard his voice, he lifted his head and feebly wagged his tail. But more than that he could not do, for death came upon him there in the hour of his joy at the sight of his old master, whom none but he, the faithful companion, had recognized.

THE STORY THAT HAD NO END

THERE was a certain king who, like many other kings, was very fond of hearing stories told. To this amusement he gave up all his time; but yet he was never satisfied. All the exertions of his courtiers were in vain. The more he heard, the more he wanted to hear. At last he made a proclamation, that if any man would tell him a story that lasted for ever, he would make him his heir, and give him the princess, his daughter, in marriage; but if anyone should pretend that he could tell such a story, and should fail—that is, if the story did come to an end—he was to have his head chopped off.

For such a rich prize as a beautiful princess and a kingdom, many candidates appeared; and dreadfully long were the stories that some of them told. Some lasted a week, some a month, some six months: poor fellows, they all spun them out as long as they possibly could, we may be sure; but all in vain; sooner or later they all came to an end; and, one after another, the unlucky story-tellers had their heads chopped off.

At last a man came who said that he had a story which would last for ever, if his Majesty would be pleased to give him a trial.

He was warned of his danger. He was told how many others had tried, and lost their heads; but he said he was not afraid, and so he was brought before the king. He was a man of a very composed and deliberate manner of speaking; and, after making all requisite stipulations for time for his eating, drinking, and sleeping, he thus began his story:

"O king, there was once a king who was a great tyrant; and, desiring to increase his riches, he seized upon all the corn and grain in his kingdom, and put it into an immense granary, as high as a mountain, which he built on purpose.

"This he did for several years, till the granary was nearly filled to the top. He then stopped up doors and windows, and closed it up on all sides.

"But the bricklayers had, by accident, left a very small hole near the top of the granary. Then there came a flight of locusts, and they tried to get at the corn; but the hole was so small that only one locust could pass through it at a time. So one locust went in and carried off one grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn——"

He had gone on thus from morning to night, except while he was engaged at his meals, for about a month. Then the king, though a very patient king, began to grow tired of the locusts, and interrupted his story with:

"Well, well, we have had enough of the locusts; we will suppose that they have had all the corn they wanted; tell us what happened afterwards."

The story-teller answered, very deliberately: "If it please your Majesty, it is impossible to tell you what happened afterwards before I have told you what happened first."

The king listened with admirable patience six months more, when he again interrupted him: "O friend, I am weary of your locusts! How soon do you think they will finish?"

To which the story teller replied: "O king, who can tell? At the time to which my story has come, the locusts have cleared away a small space, it may be a cubit each way round the inside of the hole, and the air is still dark with locusts on all sides; but let the king have patience, and no doubt we shall come to the end of them in time."

Thus encouraged, the king listened on for another full year, the story-teller still going on as before.

At last the poor king could bear it no longer, and cried out:

"O man, that is enough! Take my daughter, take my kingdom, take anything—take everything, only let us hear no more of those abominable locusts."

And so the story-teller was married to the king's daughter, and was declared heir to the throne; and nobody ever expressed a wish to hear the rest of his story, for he said it was impossible to come to the other part of it till he had finished with the locusts. Thus the folly of the foolish king was stopped by the ingenious device of a very wise man.

KING OF THE GOLDEN MOUNTAIN

A VERY long time ago there lived a rich merchant who had two little children, a boy and a girl. All his riches were in two big vessels on the sea, and he was expecting them home. But one day he was told that both ships were lost, so he had nothing left but a little field.

One day he was feeling very sad, and was walking in his field, when suddenly a very ugly dwarf stood before him and said: "Why do you look so sad?"

The merchant replied: "I have lost all my money, and all I have left is this little field."

Then the dwarf said: "Don't worry any longer. If you will bring me in twelve years from now, the first thing you meet on the way home, I will give you as much gold as you like."

"Very well," said the merchant, thinking that his dog would probably meet him on his way home, "I will do as you ask." But, to his great sorrow, his little boy ran to meet him.

A month passed, and the merchant thought to himself: "I have not got any gold yet; the dwarf must have been joking with me." But one day he went up to an old attic to get some iron he thought he might sell, and there on the floor was a great heap of gold. He was delighted to become rich again.

The years went by, and his little son grew up to be a young man; and then the father, remembering his agreement with the dwarf, grew very sad, and told his son that he had promised to give him to an ugly dwarf. But his son comforted him, and said: "Father, never fear because of your promise; I will not let the dwarf take me away from you."

So when the time came they went to the little field to meet the dwarf, and the son drew a round ring on the ground and stood inside of it with his father. The dwarf soon came, and said to the merchant: "Have you brought me what you promised?"

But the old man did not answer, and his son said: "What do you want here?"

The dwarf answered: "I did not come to talk to you, but to your father, and I *will* have what he promised me."

Then they quarreled for a long time, and at last it was decided that the merchant should put his son into a little boat all by himself on a large lake that was near. He thought that his son would be drowned, so he went home feeling very sad. But the little boat went on and on, and at last stopped outside of a beautiful castle, which was quite empty, for it was enchanted. The young man jumped out of the boat, and went through all the rooms in the castle until he came to one with a white snake in it.

Now the white snake was really an enchanted princess, and she was delighted to see him, and said: "You have come at last to save me. I have been waiting for you for twelve years. You must do exactly what I tell you. To-night twelve black men will come with chains hanging all round them. They will ask you why you are here, but you must not answer, even if they beat and hurt you. The second night twelve others will come, and the third night twenty-four more will come and cut off your head; but at twelve o'clock on the third night their power is gone, and I shall be free, and will come to you, and will wash you with the water of life to make you live again."

All these things happened just as the princess had told him, and the third night the white snake changed into a beautiful princess and married the merchant's son, and he became the King of the Golden Mountain.

They lived a long time together, and were very happy, and the queen had a little son. One day the king thought of his poor father, and he longed to go and see him again. But the queen did not want him to go, and said: "If you go, I know that something dreadful will happen." But he would not listen to her pleadings. So the queen gave him a wishing-ring, saying: "Put this on your finger, and it will bring you whatever you wish for; but you must promise not to wish that I may be with you when you are at your father's house."

The king promised to do as she asked, and, turning the ring on his finger, wished to be near the town where his father lived. But the soldiers who guarded the city would not let him enter it, because his clothes were so different from theirs. So he borrowed an old shepherd's frock, and went to his father's house. But his father did not recognize his own son, and said:

"You are certainly not my son, for he died a very long time ago."

Then the King of the Golden Mountain replied: "I am really your son. Is there no mark by which you can tell that I am your son?"

"Yes," said his mother; "our son has a mark like a raspberry under his right arm."

were with him, and they instantly stood before him. The queen was very sorrowful, and said that he had broken his promise, and that ill-luck would come to them.

One day the king and queen went for a walk together, and the king showed her the place where he was put into the little boat. Then, feeling very tired, they sat down, and he went to sleep.

THE DWARFS ILL-TREATED AND TORTURED HIM, BUT HE REMAINED SILENT

Then he showed them this mark, and they were convinced that he was their son. He then told them all his adventures, how he was a king, and was married to a beautiful princess, and had a little boy seven years old.

But the merchant said: "You cannot be telling the truth. What king would travel about in an old shepherd's frock?"

Then the king was very angry, and wished that the queen and his little boy

The queen, wishing to punish him for having broken his promise, took the wishing-ring off his finger, and wished herself and her son back at the castle. When the king awoke he found himself alone, and saw that the ring had gone from his finger. He said to himself: "I can never go back to my father's house; they would say that I was a sorcerer. I will go a long journey to discover the whereabouts of my kingdom."

So he started off, and walked on till he came to a mountain where three giants were quarreling over their inheritance. When they saw him pass they said to each other: "Little men have sharp wits; he shall divide the inheritance between us."

This inheritance was a sword which could cut off anybody's head when the wearer said "Heads off!" a cloak that made the owner invisible, or gave him any form he pleased; and a magic pair of boots that took the person who put them on to wherever he wished to go.

The king said to the giants: "I must try these wonderful things first; then I shall be able to decide for you."

Then they gave him the cloak, and he wished himself a fly, and he immediately became a fly.

"The cloak is all right," he said; "now give me the sword."

"No," said they, "not unless you promise not to say 'Heads off!' If you do, we shall all become dead men."

So the king tried its magic power on a tree standing near by.

Then he said: "Give me the boots to try, too." And as soon as the clever king got all three he wished himself back at the Golden Mountain, and immediately he was there. As the king came near his castle he heard merry music, and the people round about told him that his queen was about to marry another prince. When the king heard this he was very angry, and putting his cloak around him, he went to the castle. A great feast was being held, and the king sat unseen beside the queen, and when anything was given her to eat and drink he took it away from her. When the queen saw this she was much frightened, and went away to her own room, the king following her.

"Alas!" she said to herself, "I am still in the power of some enchantment."

Then the king took off the cloak, and said: "I did save you, but you deceived me. Have I deserved this bad treatment from you?"

Then he went out and told all the merry-makers to go, and said the wedding would not take place, as he was the right king. Then the princes and nobles laughed at him, and tried to seize him; but the king drew his magic sword and cut off all their heads.

So he became once more King of the Golden Mountain, and lived happily with his queen and son ever after.

NAPOLEON'S WONDERFUL ESCAPE

It is interesting to know the story of Napoleon's wonderful escape, at the time when the Royalists were plotting against his life. They planned to kill him by means of the infernal machine, or *machine infernale*, as the French called it. It consisted of a barrel of gunpowder, and it was placed on a cart, to which it was strongly bound by cords, with grape-shot piled round about it, and with a slow-match attached to the powder. The conspirators were Bourbons, who wished to get Napoleon out of the way, so that the monarchy might be restored. The night of the outrage was December 24, 1800.

On this night Napoleon was going to the opera. The conspirators wheeled their carriage, which had been prepared by a Breton peasant named Georges Cadoudal, into the Rue Saint Nicaise, and waited for the procession to go by. At the right moment the match was ignited, and some of the conspirators actually stood by to watch the havoc of the explosion. The match burned a trifle slower than these monsters had imagined. The carriage containing Napoleon passed the loaded cart. But hardly had it gone by when a terrific explosion took place. The street was immediately plunged into darkness. The crash of shivered glass and rolling stone mingled with cries of agony and terror. Twenty people were struck dead. Fifty-three, including the conspirator who had lighted the match, were horribly wounded. The whole neighborhood was thrown into the most frightful panic imaginable.

Out of the quiet night, in the centre of happy Paris, and far from scenes of war and death, there had suddenly leaped this terrible thing of slaughter and destruction, scattering agony and death among innocent women and children, and filling the minds of people with the madness of terror. That is the reason why the French gave to this wicked invention the name of *machine infernale*, or infernal machine. Napoleon escaped without injury; but never was he in greater peril.

THE FABLES OF THE BUDDHA

There was once a King of Persia who read that on the mountains of India grew a tree which gave a medicine that brought the dead to life. The king sent his chief physician to India to get some of this medicine, and the physician met a wise man, who said: "Your king did not understand the book. By the mountains of India are meant the greatest of her wise men. The Tree of Life is the wisdom that grows from their minds, and their writings are the medicine which brings the dead to life." Then the wise man gave the physician a book of fables. This book of fables has been translated into many languages. Some of its tales were composed by the Buddha, the great religious teacher, whose life is related on page 3023, and others were collected by Buddhist monks, about 2,300 years ago. Here are some of the stories.

THE STRONGEST THING

AN Indian magician was walking one evening by the bank of the Ganges, when an owl flew by, carrying in its beak a little mouse.

Being frightened, it dropped the mouse, and the Magician, who was a kind-hearted man, took the little creature home, and healed it, and changed it into a very beautiful girl.

"Now, my dear," he said, "I must find you a husband. Whom would you like to marry? I am a great magician, able to perform wonderful things, and I can carry out your slightest wish."

The adopted daughter of the Magician seemed pleased; her eyes twinkled.

"I should like to marry the most powerful being in the universe," she said.

"There is nothing in the universe more powerful than the Sun," said the Magician. "I will marry you to him." So he asked the Sun to marry her.

THE MAGICIAN CHANGED HER TO A MOUSE

"I am not the most powerful being," said the Sun. "Look at the great Cloud that covers me and hides my light. He is far greater and stronger than I."

"Well, you must marry my adopted daughter," said the Magician to the Cloud.

"There's somebody stronger than I," said the Cloud. "The Wind tosses me about just as he pleases."

But the Magician found that the Wind was not as powerful as the Mountain which towered, terrace upon terrace, right up into the sky, and stopped the fiercest tempest.

"And there's somebody stronger than I," said the Mountain. "Look at the Mouse which bores holes in my side, and lives there whether I like it or not. All my strength will not frighten him away."

The Magician was grieved at the result of his inquiries. He felt sure that his adopted daughter would never stoop so low as to wed a mouse. To his great surprise, however, she was delighted to hear that the Mouse was the strongest creature in the world. So the Magician changed her back into a mouse, the shape in which he had found her, and the two were very happily married.

You can alter anyone's appearance, but that does not alter his nature.

THE WISE AND FOOLISH FAIRIES

WHEN the Fairies of the Trees set out to choose their dwelling places, some were wise and some were foolish.

The wise fairies shunned the trees that stood alone in the open fields, and settled in a thick forest.

But the foolish fairies said: "Why should we crowd together in a forest? Let us go and live in lonely trees near villages, where men will bring us gifts."

But one night a great tempest swept over the country. The lonely trees were blown down, and the foolish fairies became homeless. But the great, dense forest resisted the fury of the storm, and none of the trees there was injured. And the wise fairies said to the foolish fairies:

THE FOOLISH FAIRIES BECAME HOMELESS

"People should stand united like a forest. It is only the solitary tree growing unprotected upon the bleak hills or in the open fields that is overthrown or broken by a storm."

Union is strength.

A CRANE grew too old and feeble to catch the fish that lived in a lake close to his nest. So he resolved to do by cunning what he could no longer do by force. And he said to a crab in the lake:

"My dear friend, what will you and all the fishes do now? Some men are coming presently to drain every drop of water out of the lake. You'll all be caught and killed!"

On hearing this dreadful news, all the fishes assembled to try to find some way to escape.

"I have thought of a plan," said the cunning old Crane. "Of course, I eat one or two of you now and then; but I don't want you to perish in a heap for want of water. What good would that do to me? Now, there is a large pond just a few hundred yards away. Let me carry you, one by one, in my beak to this safe place."

The fishes got an old carp to go with the Crane to see if there was such a pond. The Crane took him very gently in his beak and showed him the new stretch of water, and then put him back among his companions, and when the fishes heard about the pond they cried:

"Very well, Mr. Crane; you can take us all with you!"

The cunning old Crane meant to take the fishes one by one in his beak, and eat them under a tree far away from the pond; but, unhappily for him, he began with the wise Crab.

"Come along," he said to the Crab, "and let me take you in my beak to the new pond."

"I don't like to trust myself in your beak," said the Crab. "You might let me fall and break my shell. We crabs have a famous grip. Let me catch hold of you round the neck, and then you can take me."

The Crane did not see that the Crab was trying to outwit him, and agreed to the proposal. But when the Crab was fixed on his neck, instead of going to the pond, he went to the tree.

"Where is the pond?" said the Crab.

"Pond?" said the wicked old Crane. "Do you think I'm taking all this trouble for nothing? The whole thing is just a trick for catching you and the other fishes, one by one, and eating you."

HE DROVE HIS CLAWS INTO THE CRANE'S NECK

"Just what I thought," said the Crab. And he drove his claws into the neck of the wicked old Crane, and killed him.

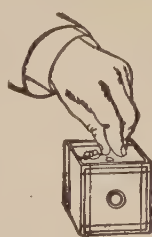
The wicked and cunning are always caught in their own traps.

USING THE CAMERA OUTDOORS

CONTINUED FROM 4202

PHOTOGRAPHY is one of the most interesting of all hobbies, for it enables us to keep a pictorial record, that is, a record in pictures, of the places we visit during the holidays, and of anything that happens to us, or to those around us.

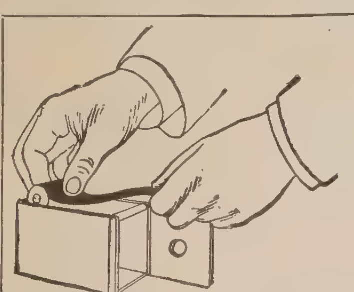
Most cameras made nowadays can be loaded in daylight. This does away with the necessity of going to a dark-room every time we want to put in a new roll of films. In loading a box-camera, place it upon a table, and unlock it by turning the nickel catch to the right, as shown in figure 1. This releases the winding key, and allows the door at the back to be opened. Place the cartridge in the clip on the right side of the holder, as shown in figure 2. Now pass the black paper across the opening and in front of the flap, and insert the end of the paper through the slit in the empty reel, as shown in figure 3. Place the spool in position, close the camera, and turn the key until the number 1 appears at the little red window. It is now ready for us to take photographs.



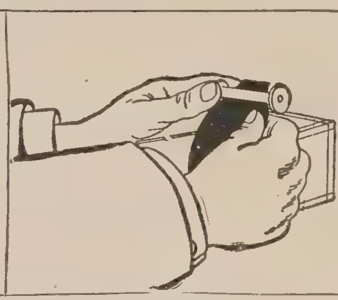
1. Unlocking the camera.

If we wish to take outdoor pictures, we must observe certain principles in order to have good results. In landscape photography we must have one main object in the picture that exceeds all others in interest. For example, a bit of cloud, a vessel, a single tree, or some one object that attracts the eye will add to the interest of the view. A second principle we must remember is not to divide the picture exactly in the middle by the horizon line. Try to give a larger portion of the picture either to the sky or to the land. It is well to have a roadway or path in the scene to direct the eye from the foreground gradually to the distance. A stream of water catching glimpses of light or reflection of trees, will serve the same purpose of leading the eye into the picture.

Remember that a camera does not see pictures in color as we do, but it sees everything in black and white, or masses of light and shade. It is the light shining upon things and creating shadows that makes the photograph for us. We must not point the camera toward the sun if we wish to get a good picture. If the sun is shining directly into the camera, protect the lens at the moment of exposure by holding your hand or a piece of cardboard above the top of the lens or a little to one side to screen it.



2. Inserting the film into the camera.



3. Fixing the black paper in position.

Remember to hold your camera motionless and also level, since tipping it in any way gives distorted views. If thecamera is tipped up, the vertical lines in the picture will seem to come together at the top; and if the camera is tipped down, the lines will seem to meet near the bottom.

HOW TO TREAT BROKEN BONES

A THIRD LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM PAGE 4201

PERHAPS the most common form of accident in which the rendering of first aid to the injured person is necessary is that in which some bone of the body is broken. This breaking of a bone is called a fracture, and fracture comes from a Latin word meaning to break. A fracture may occur by what is called direct violence, as when a blow is given or a wagon wheel runs over a foot. In these cases the bone breaks at a place where the force is applied. A fracture may also occur by indirect violence, as when a boy falls on his hands and breaks a collar-bone, or when a man falls on his feet and fractures his skull.

Now, all the people who are so unfortunate as to break a bone do not do so in the same way, and different names are given to the different kinds of fractures.

Bandage and sling for a broken humerus.

A simple fracture is where the bone is broken once, and there is little or no injury to the soft parts of the body near the bone.

A compound fracture is where, in addition to the broken bone, there is a wound leading from the outside of the body to the bone, thus enabling germs in the air to reach the broken bone. Sometimes the wound is caused by the sharp end of the broken bone sticking through the flesh, and at other times it may be inflicted from outside by the implement that broke the bone, as when a bullet breaks a bone.

A complicated fracture is when there is not only a broken bone, but an injury to one of the organs of the body, as to a lung, or to the brain, or to an important blood-vessel. A multiple, or comminuted, fracture is the breaking of the bone in more places than one, and, of course, this kind of fracture may also be compound. Comminuted is derived from a Latin word that means crushed or powdered.

The large sling.

An impacted fracture is one in which the two ends of broken bone are forced into one another. A greenstick fracture takes place when a young child meets with an accident that would result in a broken bone to an older person. The child's bone, being soft, acts very much like a green branch, because, instead of breaking right across, it bends and cracks only.

In this lesson we are going to learn what to do in the case of broken arms and legs, but first of all we must learn to know when bones are broken. There are some methods of knowing that a bone is broken which must be used only by a qualified doctor; but there are five different tests that we who are going to render first aid may apply without any risk, and by some or all of these we can tell beyond doubt when a fracture has occurred.

First of all, there is usually pain at the place where the bone is broken. Then there is what doctors call inability—that is, loss of power in the limb below the place where the bone is broken. The part where the fracture occurs will usually be swollen, and it is important that we should not think a person is less seriously injured than he really is because, owing to the swelling, we cannot see some of the other signs of a fracture. If there is the slightest doubt as to the nature of an injury, it is by far the best to treat it as a fracture. The part where a bone is broken often becomes deformed—that is to say, has an unnatural position or appearance. A broken leg, for instance, may sometimes appear shorter than it should be. When the broken bone is quite near to the skin, by drawing the hand gently along the surface of the place we can often feel and locate the break. Of course, if the fracture is a compound one the bone can be seen.

The most important thing to remember in a case of fracture is that the patient must on no account be lifted off the ground to be placed on a stretcher or in a cab until some kind of splint or support has been found and tied to the broken limb to keep it in one position.

For first aid, proper medical splints are not often available, and so we have to make use of anything that is ready to hand, and it is most surprising how many things can be utilized for splints. Among other things that are useful are umbrellas, walking-sticks, baseball bats, rifles, flag-sticks, pitchforks, fireirons, boards, fence-posts, boughs of trees, bundles of twigs, bundles of fire-wood, pieces of stout cardboard, newspapers folded up, billiard-cues, rolled-up maps or any pictures that have a wooden roller, tools such as chisels, hammers, saws, and screw-drivers. The chief thing that is needed in a splint is that the article used should be long enough and firm enough to keep the parts of the limb above and below the fracture perfectly free from the slightest movement. Splints of all kinds should be padded with clothing.

Splints are tied to the broken limb with bandages, and the regular triangular bandages are the best; but if these are not to be had we may use neckties, scarves, belts, strips of toweling or sacking, or, indeed, anything that can be transformed rapidly into a bandage. The bandages adjusting the splint should be placed twice round the

limb and splint, if possible, before tying, and they should always be tied firmly, though not tightly.

When regular triangular bandages are used, they should be folded narrow when they are wanted for the arm or forearm, and narrow or medium when to be used for the thigh or leg. When tying the splint in position, the bandages above the fracture should be put on first, in order to keep the splint firm. Of course, should there be bleeding from the wound, this must be carefully attended to before the splints are put on; but we shall learn how to stop bleeding in a later lesson.


A broken forearm bandaged.

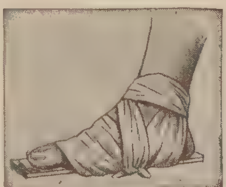
After a fracture has been attended to, the patient must be covered with coats or other garments to keep him warm, even though the weather be not cold.

Now we shall learn how to treat different fractures of the arm or leg. When the humerus is broken, we make three or four short splints reaching from the shoulder to the elbow, securing them in position with bandages as shown in the first picture. The first splint must not be so long that it will press on the blood-vessels at the elbow-joint. The forearm must then be supported in a small sling. There are two kinds of arm-slings—the large and the small—both made from a triangular bandage. For a large sling we open out the bandage, place one end over the shoulder on the uninjured side and, bringing it round the neck, tie it with a reef knot to the other end as shown in the second picture. The loose point is brought in front of the injured arm and pinned with two pins. For a small arm-sling we use the triangular bandage folded broad, and tie it round the neck in the same way as a large bandage.


Bandage for broken fingers.


A broom used as a splint for a broken thigh-bone.

When the forearm of an injured limb is placed in a sling, the hand should always be slightly higher than the elbow. Of course, where no proper bandages are available, anything may be used for a sling. When there is a fracture of one or both bones of the forearm, take two well-padded splints reaching from the elbow to the finger-tips, put one inside near the body and one outside, and bandage them to the arm, using three bandages, one above and one below the fracture, and one round the hand, as shown in the third picture. Then support the forearm in a large arm-sling. For a fracture of the hand or fingers, put a padded splint to the front of the hand from beyond the finger-tips to above the wrist, bandage with a narrow bandage as shown in the fourth picture, and support in a large arm-sling. It is important that a fracture of the arm, or wrist, should be properly treated from the first, otherwise it may never regain its full strength and use.


A broken foot bandaged.

Fractures of the elbow-joint are serious and must not be left longer than absolutely necessary, as they require proper medical attention. We should in such cases simply rest the arm upon a pillow in the most comfortable position, and summon a doctor as quickly as possible.

A fractured thigh-bone is a most serious injury, and must have careful attention. We must place the patient on his back. Then someone must hold the ankle and foot, and very gently pull the foot down until it is quite level with the other foot. Then, while the foot is held in position, a long splint reaching the entire length from the foot to the armpit must be placed on the outside of the injured leg, and a shorter splint inside, and the whole bandaged carefully together as in the fifth picture. One bandage goes round the body below the armpits, the next round the hips, the next just above the fracture, the next just below the fracture, the next lower down the leg, and the next round the ankles, to be tied beneath the foot. Still another bandage is tied round the knee. The inner splint is often dispensed with, and the two legs are tied together, the sound leg supporting the injured one.

When the kneecap is fractured, the patient should lie on his back with his shoulders and head raised up. The leg should be straightened, and the foot raised and rested on a cushion, block of wood, heap of clothing, or anything of that kind that is immediately available. A long, flat splint is placed at the back of the leg and tied just above and below the injured kneecap, at the thigh, and just above the feet. It is most essential that the foot be kept raised off the ground until the doctor arrives.

For a fracture of either or both of the lower leg-bones, the treatment is as in the case of a fractured thigh, with the exception that the splints are kept in position by bandages tied immediately above and below the fracture, just above the knee, round both ankles, and round both knees.

For a crushed or fractured foot, remove the shoe by slitting the back seam and undoing the laces, place a padded splint to the sole of the foot from toe to heel, and bandage like a figure eight, as shown in the sixth picture.

Always remember in tying the bandages that, no matter where the fracture may be, or what kind of fracture it is, the bandage must be tied firmly, but not so tightly that it will interfere in any way with the circulation of the blood. That would be very harmful for the patient, and if persisted in might cause a very painful sore. A bandaged hand should be slightly raised in order that the fingertips may be at a higher level than the elbow.

CONTINUED ON PAGE 4382

MAKING A COLLECTION OF ROCKS

WE read all about the crust of the earth upon which we live on page 2919 of this book and on the pages that follow, and it will be a recreation that is both entertaining and instructive to form a collection of rocks and fossils. These will provide literally "sermons in stones," for every stone, dumb as it may seem, has a story to tell and a lesson to teach.

WHAT THE COLLECTION SHOULD CONTAIN

In making a collection of stones and rocks, we should aim to have every layer of the earth's crust represented. There should be specimens of the rocks formed by the action of fire, rocks formed of material deposited by water, pieces of those parts of the earth's crust formed by layers of vegetable matter, like the coal measures; and then we should have as many varieties as possible of fossils—that is, creatures that lived in a bygone age and have been turned into stone and thus preserved. Then, wherever we keep our collection of stones, we should always try to keep them in their right order— that is, according to the age when formed, or, what usually means the same thing, the depth at which they were found.

WHERE TO OBTAIN SPECIMENS

Specimens of many rocks are not difficult to obtain. We may find many specimens lying about on the seashore when we are away on a holiday—and it is astonishing what a variety of rocks may be got together in this way in the course of a few years—granites, limestones, sandstones, serpentine, quartz, madrepore, or coral, and so on.

Then we may sometimes find a specimen we are wanting on one of the roads of our cities or towns. Some years ago a boy who belonged to a geology class saw in a macadamized road that had recently been relaid with stones, though not yet gone over with the steam-roller, a piece of interesting rock called mica-schist. Stooping to pick this up, he found by its side another rock called gneiss, and then a fossil, half embedded in rock. This aroused his interest, and he picked up another and another until all his pockets were full.

Having shown his fellow-students the fine geological collection that he had secured in this unusual and unexpected way, it was not long before thirty or forty boys were wandering up and down the road picking up stones here and there, and filling their pockets. This went on for several days, until at last a policeman was stationed at the place to guard the road. Probably it was the first time that the guardian of the law had had to protect the road itself from being carried away. Of course, the wholesale removal of a macadamized road is not recommended, but by keeping our eyes open, even in the streets of our towns, we may often come across a specimen well worth adding to our collection.

TOOLS FOR OBTAINING MINERALS

Naturally, the specimens that teach us most, and that will in after years be of most interest to us, are those that we actually chip out of their rocky bed in some quarry or cutting. For this purpose we need quite inexpensive tools—simply a good steel hammer and a strong chisel of good quality. In selecting the hammer, we should see that the head is broad and thick at one end, and that the other end is wedge-shaped. A hammer of this kind is quite indispensable to the geologist, and it will be found to serve its purpose far better than a hammer of any other shape.

When we secure a specimen, we should chip it into a convenient size and shape and wrap it up in a piece of paper, upon which we should write the place in which it was found and the date when found.

There are many places in which we may chip out our own specimens—railway-cuttings, road-cuttings, quarries, mining works, brick-pits, and so on; and the workmen at these places will be found to be generally very civil, and willing to assist us in securing specimens. If we are living or staying near any of these works, we can often induce a laborer to save us anything interesting that he comes across in the way of fossils, and we can learn from the men where fossils are most likely to be found in the district.

HOW TO KEEP THE SPECIMENS

On arriving home after an expedition, we should sort out our newly obtained specimens, write a neat little label for each, bearing the name of the place where it was found, the name of the rock, and, if we know it, the geological name of the formation, or the layer of rocks, from which it came, and paste each label upon the specimen to which it belongs.

To serve as cases for our rocks and fossils, if we have no proper cabinet at home, we can obtain flat wooden boxes for a few cents from the grocer or druggist, or make flat trays with rough compartments to hold the specimens, which as a rule should not be larger than a big walnut.

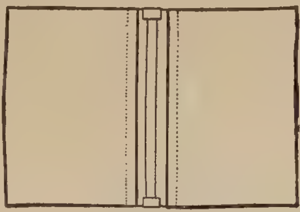
No region in the world will afford a more varied collection of minerals or of fossils than North America, especially if the collector happens to live among the mountainous parts in New England, or along the Alleghanies; the whole country is a sort of geological museum, for the strata or layers of rock in the crust of the earth have been so broken and heaved, and then so ground down on the crests of the ridges, that the edges of almost the whole series of strata are sometimes exposed to view. This is still more true of the Rocky Mountain region, where thick masses of strata stand almost upright against the mountains which have been thrust up through them like wedges. Then, too, the rivers have cut deep trenches through the strata in some places, so that you can see just how they lie, and of what they are composed.

But it is also possible to collect many varieties of minerals and rocks even in the prairie country, by studying the pebbles and boulders which have been left there by the ice of the Glacial Period—a matter you will need and want to read about the moment you become interested in your subject.

HOW TO MAKE A DAINTY BLOTTER

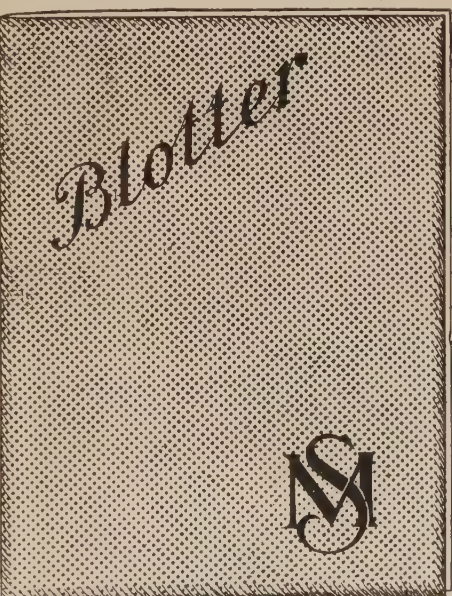
A DURABLE and neat blotter which will hold notepaper and envelopes, and has a cover that can be taken off, washed, and put on again, is a useful thing to possess. The one described here is easy to make, and quite inexpensive.

The materials required are two pieces of stiff cardboard to form the two halves of the cover, a strip of calico to bind them together, some crash or colored linen to cover the cardboard, a fine cord to sew round the edge of the cover, and a skein of embroidery floss or mercerized cotton, costing 5c., for working initials or a pretty design on the cover.


1. The foundation.

A crash material, thirty-six inches wide and costing 25c. a yard, is frequently used for making blotters, because it is substantial, washes well, and, being of a canvas texture, may be readily embroidered. A suitable cotton cord costs very little, and a silk one can be got at 5c. a yard.

The blotter can, of course, be made any size we prefer. For a large one measuring twelve inches by nine, half a yard of crash would be ample. The two cards—a good white cardboard is best—should be cut quite within these measurements, and should be exactly the same size, with smooth, neat edges. The strip of calico should be about one and a quarter inches wide and longer than the card covers. These are placed side by side face downwards, about three-eighths of an inch apart, and the strip of calico is then stuck on the adjoining edges with liquid glue or a strong gum. Care must be taken not to let the pieces of card touch, for if they do so the blotter will not open and shut easily. The ends of the calico are doubled over and stuck on neatly, as we can see in the first picture.



2. Design for the cover.

When the card foundation is made it is put aside to dry, and while it is drying we can set about cutting out the material for the cover.

If the material permits, the outside and the two pockets for the inside may be cut all in one long strip of thirty-six inches, just the width of the crash material, eighteen inches forming the back and front, and nine inches each for the inner pockets. The picture shows how the pockets inside are made. A broad hem prevents their openings from fraying, and their sides are run up on the wrong side. Before running them up, it is advisable to test the fit of the cardboard foundation which is to be slipped into them. And if we intend to embroider the front cover in any way, now is the time to do it, as it is so much easier to handle it before the pockets are sewn.

Picture 2 shows a design for the cover outlined in deep pink embroidery floss. If we cannot draw the monogram, we can buy little model card letters at two cents each and work these on to the material with satin stitch. A pattern can be transferred in the way described on page 1517.

Having made the pockets, we next stitch the cord round the edge of the cover, choosing for its color a pretty pink or perhaps a blue to match the embroidery on the outside. Before placing the card foundation in the cover, we must cut out three sheets of blotting-paper, fold them to the size of the blotter, and stitch them on to the calico strip in the same way that pages of an exercise-book are stitched on to the cover.

Now we can slip the two cards into the two pockets of the cover, and our blotter is ready for use. If we are thinking of giving our blotter as a present to a relation or friend, we could, of course, make it look prettier and daintier by working a more elaborate design, or, better still, quite charming covers could be made of brocade or thick corded old rose or green silk, although this works out a little more expensive.

Should there be enough material left, a good idea would be to make a cover in exactly the same way for a telephone book or a time-table. The paper covers are slipped into the pockets, and a fine cord is passed round the back of the cover and half-way through the book to keep it securely in the cover. A suitable design for this would be a railway signal-post and arm bearing the title of the book, or we might have the name Telephone Directory worked in a contrasting color up the back of the cover, or slantwise on the front.

The best plan is either to write the letters ourselves in pencil, or to get someone who writes a nice flowing hand to do so for us, and then embroider over the pencil. If printing is one of our good points, we may prefer to print the letters, or we may even use a stencil pattern.

GAMES FOR A CHILDREN'S GARDEN PARTY

Of the many games that can be played at a garden party, none is more amusing than balloon-breaking on "horseback." Each player must get a grown-up friend to act as horse, and must be armed with a long, pointed stick to use as a lance.

In the game of balloon-breaking the player wins who, with his stick, breaks the balloon, which is fastened to a piece of string. A player on foot runs round with the balloon, jerking it about to prevent it from getting broken, and the fun depends on his skill

A human wheelbarrow race is always exciting, for there are generally some spills that cause much laughter. The course should be not more than thirty yards long, and we see here the correct way to stand at the start. As soon as the signal is given they start.

A toy motor race is good. Each competitor has a partner half-way down the course, who throws a ball as the cyclist comes up. The cyclist catches this, cycles to the end, drops the ball in a bucket, and returns. The player who first returns is the winner

An Indian race is always popular. The competitors run to a tent fifty yards away, where each finds an outfit consisting of a head-dress, belt, arm-pieces, and anklets of feathers mounted on strips of red cloth. These are put on as quickly as possible, and the competitors then race in and out of a line of flags, without knocking any down, and thence to the winning-post, fifty yards farther on. The left-hand picture shows the competitors as they leave the tent, and on the right we see the winner of the race arriving home.

A CHILDREN'S ENCYCLOPÆDIA PARTY

WITH A PROGRAMME OF GARDEN PLAY MADE UP FROM THIS BOOK

IT sometimes happens that, when a boy or girl asks permission to give a party, the answer is: "Certainly—if you can manage it yourself, and won't expect me to amuse your guests." With a little forethought and arrangement any boy can give a most successful party if—and this is a most important thing to remember—if he carefully plans out every minute of the afternoon, and leaves nothing to chance. You will find fully described in THE BOOK OF KNOWLEDGE all the games and tricks which are suggested in the programme given below. Still other games may be found by looking in the Index.

WHAT TO DO AND HOW TO DO IT: A LITTLE PROGRAMME OF EVENTS

TIME	GAME
3.0	STICKERCHIEF
3.20	MEASURING THE HEIGHT OF A TREE
3.30	WHAT CAN BE MADE FROM POTATOES AND CUCUMBERS
4.0	A SACK RACE
4.20	TEA
5.0	CONJURING TRICKS
	A BALL THAT ANSWERS QUESTIONS
	MAGIC SCISSORS
	CUTTING THE MAGIC STRING
	THE MAGICIAN'S JACKET
5.30	HOW MARY GOT THE EGGS
	The problem can be set on the lawn with a rug and planks
6.0	SEMAPHORING
6.30	TUG-OF-WAR
6.45	HOT-AIR BALLOONING

This gives a very good afternoon's entertainment, and will sustain the merriment from the very beginning to the end. Other suggestions for a children's garden party will be found on page 4292. Inexpensive prizes of sweets or toys may be given to the winners.

THE WAY TO IDENTIFY A SELECTED CARD

TO identify a selected card without ever touching the pack of cards is sure to mystify and impress an audience.

We take a pack of cards and ask one of the audience to hold it. Then we ask another member of the audience to select a card from anywhere in the pack, to look at it so that he can recognize it again, and to show it to the audience but not to us. Then we ask the friend who selected the card to place it at the bottom of the pack. The holder of the entire pack is then requested to lay the pack on the table face downwards.

We must invite a third friend to assist us. His part of the performance is to cut the cards, that is to say, to lift any number from the top of the pack and put them at the bottom of the pack. Finally, we ask yet another member of the audience to lay the cards face upwards on the table one by one, beginning at the top and going right through the pack. When he has done this we are able to tell the audience which was the card selected.

This looks very difficult, but it is really very simple. Before handing over the pack at the beginning, we look to see what card is at the bottom of the pack. When the cards are finally laid on the table one by one, the selected card always follows immediately after the card which we saw at the bottom.

HOW DID THE FARMER ENLARGE THE FOLD?

A FARMER had fifty hurdles, and with these he made a sheep-fold that would hold exactly a hundred sheep. Later on, as he had a good deal of fine pasture land, he decided to increase the number of his sheep, and so he went to market to buy some more of these animals. Prices were low, and, although he had intended to buy only about fifty more sheep, he changed his mind and bought a hundred. The result was that, having now double the number of sheep that he possessed originally, he would require double the accommodation in his fold. A friend who had driven to the market with him remembered this, and mentioned the matter.

"Oh," said he, "I had forgotten that; but it is easily put right. I must buy two more hurdles and then I shall have sufficient room."

"Only two more hurdles to give you double the space in your fold? You have made a mistake," said the friend.

But the farmer was quite sure he was right, and he bought only two hurdles, although his friend said that he would require more.

The next day the farmer met his friend.

"Well, I have doubled the accommodation of my sheep-fold, and found the two extra hurdles quite sufficient," said he.

The friend seemed very doubtful, so the farmer took him to the field where the fold was, and in a moment the friend saw that the farmer was right. How did he do so much with only two hurdles? The answer to this little problem will be found on page 4388.

THE RIGHT WAY TO MEND THINGS

THERE are many things in use almost every day that get broken, and are then laid aside as useless, although to repair such broken things is really an easy task, if only we knew how to set about it. A few hints will be useful to us, and enable us to mend our broken toys and books and other things and make them almost as fine in appearance as when they were new.

BROKEN TOYS

Accidents happen to toys in spite of the care taken of them; but it is a pity to put them away as useless when they can be mended and made almost as good as new. Glue, tape, string, paint, nails, and paper are some of the things we shall require.

Crumpled tin soldiers can be straightened with pincers and freshened with coats of paint; bent tin trains hammered and pressed straight; broken arms of a windmill, loose wheels of carts, legs of furniture belonging to the dolls' house, and numbers of wooden articles mended with glue. If we are at all handy, we shall have no difficulty in soldering substantial metal playthings. Any of these toys when repaired would be welcomed with open arms by the children in hospitals.

TORN MUSIC

Sheets of printed music easily tear round the edges, and a slit once started is apt to end in a page torn in halves. A good way to prevent this, and also to strengthen the margin of the sheet, is to cut a piece of very thin paper the required length and width and paste it on. If a tear occurs across the printed part, we should dip a strip of tissue-paper in white of egg and use that, as the music can be read through it. A reel of transparent adhesive paper, which answers the same purpose, may be had for a few cents. A binding of narrow ribbon will greatly strengthen the back of the damaged music.

A WORN BOOK

The covers of books that have been roughly treated or imperfectly bound often tear away, half the cover usually becoming detached first. The part torn away can be mended by gumming it up the back, strengthening it with linen, and sticking the loosened half of the cover to the first page; but, if the binding be very stiff, thin glue is a better adhesive.

A loose page can be secured by folding a strip of the adhesive paper and sticking one half of it to the loose page and the other half to the next page in the book. This can be repeated on the other side of the page.

A BROKEN SPADE AND BASEBALL BAT

When the stick portion of a wooden spade breaks in two, we should get a thin piece of wood, whalebone, or steel, and, placing the broken ends together, bind it along them like a splint, with a piece of twine wound tightly and evenly round and round. A second splint adds strength, but looks clumsy. We can tuck the ends of twine in with a penknife. If the stick breaks off at the blade, the spade cannot be mended; but, if the blade is made of iron, we may burn the wood out of the socket, point the stick, insert it, and fasten it with a nail or screw. A split bat can be mended by binding it tightly with good twine, that should be beeswaxed as it is put on. We must tuck the ends of the twine in very carefully to prevent it from working loose.

TORN BATTLEDORE AND BROKEN DRUM

If the parchment of these toys get punctured and torn, we must remove all the torn part, get a piece of parchment—good type-writer paper will do—cut it to shape, soak it in white of egg, and paste it over the frame of the battledore or drum.

A PUNCTURED CYCLE TIRE

We must partly remove the outer cover of the pneumatic tire, and take out the inner tube. After pumping a little air into the tube, we should listen to locate the puncture. If we cannot find it in this way, we may feel along the surface to discover the escaping air. If this test fails, we must put the tube in a pail of water, when bubbles will rise from the puncture.

We rub the tube with sandpaper about half an inch round the hole, apply a little rubber solution to the place and also to the india-rubber patch to go over the hole. When nearly dry, we stick the patch on, pressing the edges down firmly all round. Then we rub it over with ordinary French chalk and carefully replace the inner tube in position.

A DOLL'S BROKEN HEAD

If the china head of a doll breaks off at the neck, it can be stuck on again with seccotine or glue. Thin glue is suitable for china, wax, composition, or wood, and it must be coated along the broken edges. Doll's hair can be stuck on with the same adhesive substance.

BROKEN CHINA AND GLASS

Little ornaments which decorate the mantelpiece sometimes fall and get broken or chipped. Unless they are very badly broken, it is generally worth while mending them, and mending them is often easy.

They can be mended with thin glue, which can be squeezed out along the broken edge of the china or glass, or applied to it with a camel-hair brush. We must place the broken pieces together, and hold them so for a minute or two. The drops which ooze from the join must be wiped off at once with a rag, for thin glue dries very quickly indeed, and after it has dried it is very difficult to get it off.

BROKEN UMBRELLAS

If the handle of our umbrella breaks, we may be able to repair it with glue. If this fails, it must be replaced by a new handle. A fresh elastic band and button, or tassel, which may be bought quite cheaply, can be sewn on at home. A slit in the cover may be carefully darned and strengthened by a patch of silk on the inside, put on, of course, with the umbrella half closed. It is sometimes possible to straighten a bent tube, but in the case of a broken stick or broken ribs we must take the umbrella to an umbrella repairer.

AN EASILY-MADE STENCIL PLATE

If we have a design or pattern which we should like to transfer to a book or sheet of paper and use the same pattern over and over again, we can do so by making a stencil plate in the following way, which, for outline designs, is very much simpler than the more elaborate stencil plates described on page 107.

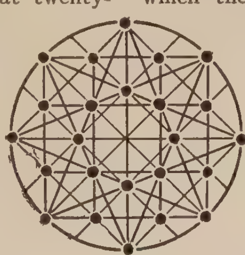
We must lay the drawing we wish to copy upon a sheet of thick paper, such as cartridge paper, and with drawing-pins fasten the two sheets together upon a table or drawing-board. Then with a pin or needle we must prick all over the outline of the design or picture, being very careful that we make the pinholes neat and clean and at fairly even intervals all over the lines.

It is essential that the paper and the picture from which we are making a stencil plate should be pinned down firmly to the drawing-board, and not allowed to move upon one another in the slightest degree while we are pricking the holes, or the outline will not be an exact copy of the picture we are tracing. Whether it is a flower, or a bird, or an ornamental design, it will, if the paper is allowed to slide about ever so little on the picture, be badly out of proportion. Now let us remove the drawing-pins and take away the upper picture. We shall find that the clean sheet of paper has the outline of the pattern transferred to it in a series of little holes. To multiply the pattern in a book or upon other paper we have only to pin this perforated sheet down and dust it over with powdered charcoal, a bag of which may be bought at any paint shop for a few cents. The charcoal should be put in a muslin bag and be shaken over the stencil, great care, of course, being taken that the stencil is properly fastened down.

The powdered charcoal will penetrate through the holes in the upper paper and the design will be transferred to the paper or book below. Then we can remove the stencil and ink in the design, or, if we so desire, color it with paint or crayons. The stencil plate can, of course, be used a great number of times; in fact, it will last for a very long time indeed if treated with ordinary care. If we find any difficulty in getting a piece of cartridge or other white paper that is stiff, we can, if we like, use a sheet of brown paper. This, if it is of a smooth nature, will do quite as well as the white, and, being tougher than ordinary white paper, will last very much longer.

THE ANSWER TO THE PUZZLE OF THE TREES

Although it had at first seemed to the gardener quite impossible that twenty-four trees could be planted in such a way as to make twenty-eight rows, with four trees in each, and these in a straight line, yet the gentleman about whom we read on page 4202 was soon able to show that this was no impossibility at all, but in fact quite an easy matter. He drew a plan which showed exactly how the trees might be placed so as to fulfil the conditions that he had laid down, and this plan, which the gardener used and followed in carrying out his master's orders, is given here so that we may see the manner in which the trees were planted.



It will be noticed, of course, that the rows do not stand one after another like a regiment of soldiers on parade, but that was not required, and, of course, with only twenty-four trees, it would be impossible to plant the rows in that way. But there are, nevertheless, twenty-eight rows, each containing four trees in a straight line, and the gentleman drew the lines of each row on his plan, for the guidance of his gardener, so that there might be no difficulty about the planting of the trees.

THE PROBLEM OF THE TRAVELER'S DINNER

The Arabs about whom we read on page 4202 were very much astonished at the decision of the magistrate, and thought at first that he must have made a mistake. But he repeated his decision, and when the traveler who had possessed three loaves protested that it was against all justice that he, who had only two loaves fewer than his companion, should receive only one coin, while the other man received seven, the magistrate offered to explain why he had ordered the money to be divided in this way.

"One of you had five loaves," he said, "and the other had three, making eight loaves in all, and then, when the third traveler came up and joined, the eight loaves were divided equally between the three of you. Now suppose each loaf to be divided into three equal parts, there would, of course, be twenty-four parts, and as you divided equally between three of you, each receive what was equal to eight of these parts. But one traveler originally had five loaves, or fifteen parts, and as he only consumed eight parts, he must have given seven to the foodless traveler. The other man had originally three loaves, or nine parts, and as he consumed eight, he only gave one part to the foodless traveler, therefore, as you can see, my decision is quite fair; the seven coins go to the man who gave seven parts, and the one coin to the man who gave one part."

Both the travelers had to agree that this was quite fair, although they had not seen it in that light before, and the man of the three loaves wished he had been wise enough to take the three pieces of money that his companion had first of all given to him.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4379.

LITTLE PICTURE STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Ceci est l'histoire d'un arbre de Noël, et d'un garçon qui s'appelle Henri.
This is the history of a tree of Christmas, and of a boy who himself calls Henry.
This is the story of a Christmas-tree and a boy named Henry.

Il avait beaucoup neigé et la terre était toute blanche de neige.
It had much snowed, and the earth was all white of snow.
It had been snowing hard, and the ground was white with snow.

Henri et ses amis firent des boules de neige. Ils eurent une bataille.
Henry and his friends made some balls of snow. They had a battle.
Henry and his friends made snowballs. They had a battle.

Dans la salle d'école il y avait un arbre de Noël, décoré de cadeaux.
In the room of school it there had a tree of Christmas, decorated of presents.
In the schoolroom there was a Christmas-tree hung with presents.

L'après-midi les enfants firent un homme de neige dans le jardin.
The after midday the children made a man of snow in the garden.
In the afternoon the children made a snow man in the garden.

"Je ferai un homme de neige pour l'arbre," se dit Henri.
"I will make a man of snow for the tree," himself said Henry.
"I will make a snow man for the tree," thought Henry to himself.

Il fit le corps, les bras, les jambes, et mit une pipe dans la bouche.
He made the body, the arms, the legs, and put a pipe in the mouth.
He made the body, the arms and the legs, and put a pipe in his mouth.

Il plaça l'effigie sur le couvercle d'une boîte et pendit la boîte à l'arbre.
He placed the effigy upon the lid of a box and hung the box to the tree.
He put the figure on the lid of a box and hung it on the tree.

Le matin il courut à l'arbre et que pensez-vous qu'il trouva?
The morning he ran to the tree, and what think you that he found?
In the morning he ran to the tree, and what do you think he found?

Une petite mare d'eau. Naturellement la glace avait fondu pendant la nuit!
A little pool of water. Naturally the ice had melted during the night!
A little puddle of water. Of course the ice had melted during the night!

A scene in the great Sahara Desert, showing a party of Bedouin Arabs moving to a new encampment.

HOW AFRICA HAS BEEN DIVIDED

EGYPT, ABYSSINIA, MOROCCO, LIBERIA, THE SAHARA, AND THE POSSESSIONS OF THE EUROPEAN NATIONS

CONTINUED FROM 4081

AFRICA is a huge, roughly-shaped, compact mass of land, three times as large as Europe, with a fifth of its surface covered with the largest desert in the world, and the rest of it rising from the surrounding seas, by great terrace steps, to high plateaus in the centre. Brimming rivers, with courses of from one to three thousand miles, plunge down the terrace steps to join the sea; mountains guard the coast nearly everywhere, the snowy peaks of those on the east side looking down on a most wonderful group of great lakes. Such is the face of Africa.

The burning sun, traveling overhead some part of the year in the greater part of Africa, looks down on millions of black and brown men—negroes and others—on millions of Arabs, on an ever-increasing number of white men from Europe, and on many of the beautiful and interesting animals with which we stock our Zoological Gardens. It is one of these animals, the elephant, with his valuable ivory tusks, that has helped to make history in Africa.

Now, the animals and the various tribes of negroes and other races, which are still in many cases heathen and uncivilized, have been there for an unknown length of time. They roamed through the great forests and lived by the wonderful rivers and lakes for ever absorbed in finding food and avoiding enemies. The valuable rubber trees in these forests have also helped in a very great measure to make history in Africa.

The Arabs, from the other side of the Red Sea, crossed over to Africa at various times through the centuries, and found their way down the coasts, over desert and plain, over rivers and mountains, all over the land. Their coming brought woe to the black men.

The white men did not begin to come, except to the coasts within hail of Europe, till nearly the time of Columbus; and their coming also brought woe to the black men. The sorrow of Africa can be summed up in three words—slaves, ivory, rubber.

In the oldest maps, made by those who lived on the Mediterranean nearly 2,000 years ago, all that is shown of Africa is the north and north-western shores, and the narrow land of Egypt in the north-east corner near the Isthmus of Suez. This neck of land, joining Africa to Asia, was, in the past, the great highway of the nations from east to west. Over it passed multitudes of people—armies for conquest, embassies from great kings, merchants who went to and fro between Egypt and the East

bridal and funeral processions. But neither the civilized old Egyptians nor the peoples of the northern shores knew much of the great continent behind the strip on which they lived, for the great desert stood as a barrier in the way. The ship of the desert, the long-enduring camel, was not used by the nomad tribes till the much later times of the Romans.

THE BRAVE MARINERS WHO FIRST DREW THE MAP OF AFRICA

We have to pass over many centuries, to the days of Prince Henry the Navigator and his brave Portuguese, of whom we read on page 3340 before much change is seen on the map of Africa. One of the results of their daring efforts, of their courage and perseverance, was that the discovery and shape of the outer rim of the great continent was made known to the world, and Africa, as a whole, could be sketched on the maps, together with the names of the settlements made gradually along the coasts by the Arab traders and the seafaring nations of Europe.

But the interior of the great Dark Continent—what of that? For a long time little or nothing was known in Europe about the vast heart of Africa, and so the map-makers were driven to fill up the blank white space with drawings of fancy animals. Indeed, those of us who were at school only half a century ago found Africa a very easy map to draw and learn—there were so few names in the middle of it.

THE JOY OF THE MEN WHO DISCOVERED THE SECRETS OF DARKEST AFRICA

On page 297 we read how strong, brave, and good men have followed each other, exploring the unknown parts of Africa, some with the view of helping to destroy the Arab slave trade and to teach the negroes, others to find out the sources of the rivers and to map out the country. Intense was their joy when the great lakes burst upon their astonished sight, and the snowy peaks came into view, and the thundering roar of mighty waterfalls on stupendous rivers deafened their ears as the boiling foam dashed high in the air. These were some of the secrets hidden so long in the heart of Africa. Of all the sorrowful ones that explorers have found, the saddest are the hard, beaten-down paths across Africa, trodden for centuries by the feet of gangs of miserable slaves, torn from their homes, which were often lake dwellings for safety. Sometimes they would carry ivory to the coast; but for none of them was there any return.

Many of the travelers are held in remembrance by the names of places on the map; and a chain of graves marks the white man's progress across unknown Africa. Much of it, owing to the great heat and the swamps, and the insects that carry infection, is very unhealthful and trying, especially to Europeans.

HOW THE SLAVE TRADE IS DISAPPEARING AS AFRICA BECOMES BETTER KNOWN

But the map is still filling up; the slave trade is gradually being suppressed; and steps have been taken to put an end to the cruelties practised on the natives who collect rubber.

Let us now turn to the relief map on page 4299, and look more closely at the great continent, with the countries of the widely differing people that live upon it. It is not all new to us, for we know its shape by reading about the British Empire in Africa in that part of our book which begins on page 1781. Its southern tip points to the South Pole; round the Gulf of Guinea it faces westwards, and its eastern horn points to India.

Here, on this north-eastern stretch, it is divided from Asia only by the Gulf of Aden and the Red Sea, which pilgrims cross on their way to Mecca, and through which steamers pass on their way from India to Europe by the short cut through the Suez Canal. As we look at the narrowness of the Strait of Gibraltar, we think again of the Moorish warriors pouring over the sea into Spain. We are probably familiar with the eastern end of the wide, far-reaching deserts of the middle of the Old World, for we read about it in the story of Arabia, Syria, and Persia, on page 3856. Its western extension, separated from the eastern side only by the narrow Red Sea and the equally narrow fertile valley of Egypt, stretches right across the wide part of Africa to the Atlantic. This is the immense desert of the Sahara, which is about as large as the whole broad extent of Canada. The greater part is rainless, sandy, rocky, or with poor, grassy lands; here and there are oases, such as we see in Asia, where springs of precious water, with refreshing vegetation, make life possible.

The hills that rise from the sun-

scorched Sahara are higher than any mountain in the great Appalachian range. The Atlas Mountains, on its northern boundaries opposite Spain, are as high as the Swiss mountains, with fine valleys and lovely scenery.

—Kilimanjaro and Kenya—both close to the Equator, and between the great lake, Victoria Nyanza, which is larger than Maine, and the sea. Both are taller than Mont Blanc by some thousands of feet.

AFRICA WITH THE NAMES OF EUROPEAN POWERS ON THE LANDS THEY CONTROL

Little of Africa is in control of the natives. The kingdoms of Abyssinia and Egypt and the little negro republic of Liberia are the only independent states. France controls the largest portion, though much of it is desert. Great Britain, Belgium, Spain, Portugal and Italy all control large divisions. The former German territories have been divided. German East Africa, now called Tanganyika Territory, is governed by Great Britain, and German South-West Africa by the Union of South Africa. France governs Cameroon, or as the Germans spelled it, Kamerun. Togoland is divided between Great Britain and France.

The Abyssinian highlands, south-west of the Red Sea, consist of high and rugged mountains rising from a series of tablelands, with deep, dark ravines between. South of the Abyssinian heights rise the twin giants of Africa

The land in this mountainous region sinks to the sea in particularly steep terraces. The hilly borders of the high inland tablelands sometimes come close down to the sea; sometimes there is a varying width of coastal plain, generally

very unhealthful for Europeans. Both act as guards that defend the country.

THE NILE, THAT FLOWS IN EGYPT LIKE A MIGHTY THOUGHT THREADING A DREAM

There is at least one immense river to every side of Africa. On the north, draining to the Mediterranean for over 3,000 miles, is the Nile, one of the most interesting and wonderful rivers in the world, "flowing through Egypt like some grave, mighty thought threading a dream." The first cataract, or rapid, on the Nile is hundreds of miles from the sea.

Into the Indian Ocean on the east side pours the great Zambezi River, opposite the island of Madagascar. Navigation is very difficult near its mouth. Its tributary, the Shiré, drains Lake Nyassa, and is of great use in passing through the country. The magnificent Victoria Falls, high upon the Zambezi itself, can only be compared with Niagara. The great river suddenly dashes over a cliff about 330 feet high, with a deafening roar, while the spray is shot high in the air. Truly it is one of the wonders of the world!

From the high tableland beyond the group of great lakes rises the mighty Congo, nearly 3,000 miles long; it circles away to the western side of the continent to empty its immense volume of gathered waters into the Atlantic. The explorer Stanley marched for five months through unbroken forests in its basin, and his name is commemorated in the Stanley Falls. There are over 6,000 miles of navigable waterway in the Congo and its tributaries, all of which enter it above the deep gorge through which it reaches the sea by many falls.

THE THREE GREAT RIVERS OF THE FUTURE THAT WATER THE HEART OF AFRICA

The Niger, with its tributary, the Benue, draining into the Gulf of Guinea, is also very important in opening up a way to some of the richest land in Africa. It touches the Sahara on the south, near Timbuktu, the central meeting-place of the caravan traffic.

The Zambezi, Congo, and Niger may be called rivers of the future, so vast are the resources to be opened up in their basins. The Nile has a great past as well as great prospects. For countless centuries it was worshipped as a god, so mysterious and wonderful are the blessings it brings to the country it has made. The mystery has disappeared since the sources of the Nile were discovered; and no longer are beautiful thanksgiving hymns sung to the Nile, nor offerings cast into its placid bosom; but it steadily goes on making and blessing Egypt. "Egypt is the gift of the Nile."

Now, Egypt is practically a long, narrow oasis in the great mid-world desert. In shape it has been compared to a lily with a bent stalk. The lily is the delta on the Mediterranean, and the stalk is the long course of the river, with the few miles of green and fertile land that lies upon either side.

HOW THE NILE COVERS EGYPT EVERY YEAR WITH A MANTLE OF FERTILE MUD

We might ask how the fertile soil, under which lies the desert sand and rock, got there. Every year through the centuries, except in black years of famine, the Nile at certain seasons has swollen and risen from its bed, flooding the lower country till it all looks like a sea of many islands, with the villages and farms standing out above the expanse of water. A mantle of delicate green is thrown over all a few months later, when the water has subsided and has left behind the layer of mud which makes Egypt so fertile. Three crops a year grow in the fields, enriched and refreshed by the waters of the Nile. It is impossible to sail or steam along the broad river-highway without being filled with wonder at the stupendous remains and ruins on its banks.

We can enjoy the grand buildings and enter into the old life of the country in another part of this book, so let us now take up the story of Egypt when the Egyptians were under the Romans.

When Britain was but an outlying, barbarous province of the great empire, Egypt, in its south-east corner of the Mediterranean, easy of access to almost every part of the Roman world, was one of the most civilized and important of its provinces. We have seen how distant Britain had to be abandoned when the empire grew weaker in the fifth century. Egypt remained under the Eastern, or Greek, Empire after the great division into East and West, and had its share of attacks and misfortunes with the rest of that long-dying Power.

THE CITIES OF NORTHERN AFRICA

The city of Algiers is nearly a thousand years old, and is a wonderful meeting-place of Eastern and Western life. For centuries it was misgoverned by its Turkish beys, or rulers, but in 1830 the French took Algiers and have made it a fine city. Its great glory is an avenue with a magnificent terrace built by an Englishman.

Tangier, the chief seaport of Morocco, is a badly-built, dirty town, where the European ministers to Morocco live. At one time it belonged to England.

Mazagan is another Moroccan seaport, which has a considerable trade in grain, almonds, wool, and oil. This is the market-place in the Jewish quarter.

Cairo, the capital of Egypt, is the largest town in Africa, and the modern city is built on the remains of four distinct towns. In the native quarter, with its narrow, winding streets, foot passengers must keep a sharp look-out to avoid being trampled upon by camels and donkeys. Cairo is noted for its beautiful mosques.

HOW THE PERSIANS CONQUERED EGYPT, BUT WERE DRIVEN OUT

The Persians, early in the seventh century, held Egypt for ten years, but were forced by Heraclius to retire. We read of this gallant emperor on page 3188. In these centuries there were great difficulties about religion. When the Egyptians accepted the Christian faith with the rest of the empire, they kept many ideas and customs connected with their ancient faith.

There were endless persecutions and difficulties between those who thought one thing and those who thought another, and the feeling became very bitter among these different sects.

When the Mohammedan troops of the Caliph Omar, about whom we read in the story of South-west Asia, on page 3858, appeared before Alexandria, the great seaport of Egypt, there was no united front in Egypt against these followers of Islam, who were able to carry everything before them.

And so Egypt passed under the sway of the caliphs and the Arab tribes, many of whom had long before made settlements round the east coast, and spread not only over Egypt and North Africa, but ever farther and farther inland. On the whole, the Egyptian Christians, or Copts, at first had a better time under the rule of the caliphs than they had had under the Greek Christian emperors; but the country was neither developed nor well governed in those luxurious days, and it was often divided by quarrels about religion. After a time began the struggles with the conquering Turks.

THE WISE SALADIN, WHO DID MUCH FOR EGYPT AND ENCOURAGED LEARNING

The great Saladin, at the end of the twelfth century, did much for Egypt by his wise government. He fortified Cairo, the capital, situated on the banks of the Nile, about 100 miles from the sea, and strengthened the country against invasion, put down rebellions, seized ports on the Red Sea, and sent expeditions in various directions. Saladin's brother and nephew carried on his efforts. The methods of storing the Nile's overflow and carrying it where needed were improved, and trade and learning were encouraged.

It was in these days that a famous cavalry corps called the Mamelukes was developed from bodyguards and brigades of strong young Turkish slaves. They gradually rose in power till the strongest and cleverest of these troops were able to make themselves in turn sultans and masters of Egypt. The story of their power, which lasted nearly 300 years, reads like a romance. At first slaves, then trained soldiers, they became chiefs and sultans.

THE SPLENDID MOSQUES THAT THE MAMELUKE RULERS BUILT FOR EGYPT

The Mameluke rulers were great builders, as many of the splendid mosques, especially that of the Sultan Hassan, and other buildings in Cairo, still testify. When the Ottoman sultans found their way to Constantinople, it was not long before they determined to conquer Egypt. In vain were extra taxes levied in the doomed country, fortifications erected, and the army strengthened. The fatal battle was fought near Cairo in 1517; street by street the capital was stormed, and the massacre of its people was carried on day after day for a whole week.

HOW EGYPT BECAME A TURKISH PROVINCE AND LOST MUCH OF ITS WEALTH

So Egypt passed to another stage in its long history, and became a province of Turkey, but it remained practically under the rule of the Mamelukes, with a ruler, or pasha, sent from Constantinople. The province, like many others, was taxed to the uttermost, and became poorer not only from that cause, but also because much of its trade passed from Alexandria to Constantinople. It also lost, about this time, the large sums it had levied on all goods passing to and from India over the Isthmus of Suez, for Vasco da Gama had found the sea-route to the East round the Cape of Good Hope.

More than 200 years passed by, during which the Mameluke beys, or governors, under a nominal Turkish chief, fought and struggled with each other, entertained lavishly, built and restored fine mosques, and encouraged Mohammedan learning and the arts, when suddenly, and most unexpectedly, the wave of upheaval set in motion in France by the Revolution reached the extreme end of the Mediterranean.

Napoleon, longing to overthrow British power in India, determined to master the East by attacking Egypt. He succeeded in bringing his fleet and army

THE DAILY LIFE OF THE PEOPLE OF CAIRO

Cairo has a large European population. Its picturesque part is the native quarter. This is truly Oriental, and the lattice-work of the houses shows Saracen art at its best. The streets are thronged, and the fruit merchants do a good business.

The streets of Cairo are narrow and winding, and the buildings present a never-ending variety of style. A traveler in the native quarter might think himself in some fairyland of the "Arabian Nights." The lemonade-seller is a familiar sight.

An old Arab writer has said that "he who hath not seen Cairo hath not seen the world; its soil is gold; its Nile is a wonder; its houses are palaces; and its air is soft, its odor surpassing that of aloes-wood, and cheering the heart." Perhaps none of its people has done so much to beautify the native city as the craftsman who works in ivory and wood, and produces the famous lattice-work. He uses his left foot as a third hand, and, because of his skill in the use of this foot, he is known in the city as the "three-handed man."

The photographs on these pages are by Messrs. Underwood & Underwood and Messrs. Valentine.

from Toulon to Alexandria, and fought the famous battle of the Pyramids before Nelson destroyed his fleet in the Battle of the Nile. We know how the brilliant successes of General Kléber, after Napoleon had returned to Europe, dwindled into complete failure, and how in the end 24,000 French troops were taken back to France in English vessels. The English themselves left Egypt soon after.

THE CRUEL MOHAMMED ALI, WHO PUT AN END TO THE MAMELUKE RULE

After this a dreadful tyrant, named Mohammed Ali, arose in Egypt. An Albanian by birth, he made his way upwards by great ability, and became pasha. He pushed his conquests to Arabia and to the Sudan, seized all the landed estates in Egypt itself, and extorted money and service from the miserable peasants, or *fellahin,* most of whom are descendants of the old Egyptians. At last he managed to get 500 of the Mameluke beys into the citadel of Cairo, and massacred them all.

We perhaps know the miserable part he and his son played when the Greeks were striving for independence, and of how Mohammed Ali finally made a brilliant success against the Sultan of Turkey, till then nominally his master. But the result of his successes were speedily lost by the rebellion of the conquered.

The chief event of the reign of Said Pasha, who was Mohammed Ali's youngest son, was the granting permission to the French engineer, De Lesseps, to make the Suez Canal. This stupendous work, nearly 100 miles long, was carried out in thirteen years, making Africa an island instead of a peninsula; and the world's ships now steam through the canal on their way north and south, carrying much of the freight and nearly all the passengers to the Far East.

THE PEACE AND PROSPERITY BROUGHT TO EGYPT BY GREAT BRITAIN

Egypt's trade had a period of prosperity in supplying cotton, which grows well there, when the American Civil War cut off the crop grown in the United States; but the country's money affairs were so mismanaged that little benefit was gained. This was in the time of Ismail, the successor of Said. Ismail, who was extravagant, and perhaps greedier than any of the rulers who had gone before him, brought the country to ruin. He burdened Egypt, the fertile part of which was not more than a third of the size of New York State, with a debt of $400,000,000. To gain the title of Khedive, or prince, he increased the yearly tribute to be paid to Turkey, and taxed the people still more heavily.

To put a stop to his misrule, the British and the French governments united to ask the Sultan of Turkey to put Ismail out of his office, and make his son, Tewfik, Khedive in his place. This was done, and after that the British and French took up the questions of taxation and the oppression of the *fellahin.* After a time the French took no further share in the government. But when the British government sent an army to put down a mutiny and restore order, they thought it better to keep an army of occupation in the country. They also sent officials to see that the Khedive ruled with justice. The real ruler of Egypt, however, was a British official called the British Agent and Consul-General. After this change in government was made the country was better governed. Taxes were cut down, and officials were not allowed to oppress the people, and so the *fellahin* had money for themselves. Railways were built, and the great dam of which we read on page 5415 was built; some schools were established and trades were taught.

In 1914 the reigning Khedive, who was a son of Tewfik, showed a desire to aid Turkey in the World War. The control of the Suez Canal by the enemy would have cut off Western Europe from the Far East. Therefore the Khedive was deposed; Egypt was declared to be entirely independent of Turkey, and was placed under the protection of the British Empire. Hussein Kamil, a son of Ismail, was made Sultan. He died in 1917, and his brother Fuad succeeded him.

For years some of the Egyptians had desired complete independence and the demand grew louder after Egypt became independent of Turkey. In 1921 Great Britain gave up all her authority in the government and Egypt was declared to be an independent kingdom. It is to be hoped that the new state will be able to preserve order.

Since the Nile dam was finished a great deal of irrigation has become possible, and large tracts of land have become as fruitful as the Delta. The country has become prosperous enough to commence to pay off its debt, and as it is now independent of Turkey, the large sum hitherto

THE PEOPLE OF TROPICAL AFRICA

In Uganda, which is now a British protectorate, missionaries have done splendid work. It was there that Bishop Hannington sealed his testimony with his blood. Here is a typical village market, and, as we can see, the natives are happy and prosperous, very different from some other African races.

This is a village in Portuguese East Africa, which lies between the Indian Ocean and the British possessions in South Africa. The country is unhealthful.

Much rubber is obtained from Portuguese East Africa, and here we see a rubber plantation near Beira. The rubber is a gum that comes from the trees.

Here are two children of the Congo. The population of this district, which belongs to Belgium, is about thirty millions and includes different races.

Here is a village on Prince's Island, in the mouth of the Congo River opposite Boma, the seat of the Government and the home of the Belgian Governor-General.

paid to the Sultan as yearly tribute is saved.

There have been endless difficulties in the part of the Sudan which lies in the basin of the Nile. Sudan means the land of the blacks. It stretches right across Africa south of the Sahara—a fertile, well-watered, and very hot belt of country, now divided among various Powers. For sixty-five years the Sudan, as far as the great lakes, had been held by Egyptian governors, whose chief idea was to get money out of the people, whom they sorely oppressed, especially in the terrible trade of slave-raiding.

HOW GENERAL GORDON WAITED FOR THE HELP THAT CAME TOO LATE

In Ismail's time, General Charles G. Gordon, a famous Englishman, was made Governor, and did good work for some years. After his resignation, tax-gatherers and slave dealers again oppressed the people. Taking advantage of their discontent, a Mohammedan preacher named Mohammed Ali—who called himself a prophet and was given the name of the Mahdi—raised a rebellion. This was about the time that the British had begun to reform the Egyptian government, and after the Egyptian army had been badly defeated by the Mahdi's troops, General Gordon was again sent out to try to restore order.

He succeeded in helping numbers of Egyptians to escape from the Mahdi, but was himself surrounded by the Mahdi's forces at the city of Khartoum. Nothing could exceed the heroism of his defence, but it was hopeless. He was killed before aid could reach him.

For eleven years the Sudan was left, cut off from the world, in an awful state of desolation, in which the people were starving and dying under tyranny of the Mahdi. Then General Kitchener, with a carefully trained army, took Khartoum and gained a brilliant victory at Omdurman. Since then railways from Egypt have penetrated to Khartoum, and connected it with the Red Sea. And in memory of the hero who lost his life Gordon College has been built, to help on the education of the people in this great district.

It is hoped that by use of irrigation the Sudan will some day be made as valuable as Egypt itself. Since that country has been given a settled government, hundreds of thousands of acres have been added to the cultivated ground, and the growing of grain as well as the raising of cattle is increasing. The possession of the country of the upper waters of the Nile is necessary to Egypt, so dependent is it on its great river to water the soil.

THE TORRENTS OF RAIN THAT CARRY THE MUD OF ABYSSINIA INTO EGYPT

When the tributaries of the Blue Nile and Atbara were traced to the highlands of Abyssinia, the mystery of the rise of the Nile and its fertilizing mud was solved. The torrents of tropical rain tear down the earth from the gorges and the cliffs, and the muddy water rushes down through Nubia over the chain of cataracts to the almost level course from Assuan to the sea. It is at Assuan that the great dam across the river has been made to regulate the supply of water. It means famine and bitter sorrow to the people of Egypt when the Nile rises too little or too much, for then the fine crops of cotton, corn, flax, sugar, and hemp fail, and there is famine in the land. But the water stored in the great reservoirs not only irrigates lands that up till now were dry and barren, but supplies enough for use in dry seasons.

Abyssinia is an independent state that has had many passages at arms with European nations. The hardy mountaineers adopted Christianity in early times; they have now many curious customs and beliefs.

At Khartoum the Blue Nile joins the White Nile, the main stream from the British district of Uganda, where it drains the Victoria and Albert Nyanza—the word Nyanza means lake. Few countries can give more exciting adventures than Uganda. The railway now connects it with Egypt and with Mombasa, the gate of Kenya, as British East Africa is now called.

A COUNTRY WHERE PEOPLE SEE LIONS AND GIRAFFES FROM THE TRAINS

Travelers speak of seeing lions, giraffes, and zebras from the carriage windows. Some of us would dread to get out at the stations! Former President Roosevelt spent months here shooting lions and hunting the huge hippopotamus and rhinoceros on the river-banks.

We read in the story of Spain, beginning on page 3339, how the Mohammedans swept along the northern states of Africa—often called the Barbary

States, from the early inhabitants, the Berbers—on their way to turn the European Pillar of Hercules into the Rock of Tarik, or Gibraltar.

For some hundreds of years they remained in undisputed possession of the coast, and then Spain began to carry its arms across the sea against the hated Moslems. In the sixteenth century pirates established themselves in the harbors of the coast; and Charles V. made many efforts, only partly successful, to dislodge them. These pirates, or corsairs, were men of extraordinary daring, and by attacking merchant ships and wealthy towns they secured great riches for their booty.

Many and grievous are the stories of the sufferings of their prisoners. They made slaves of them if large ransoms were not paid. Eventually the Turks were drawn into the almost endless contest, and succeeded in obtaining for a while the chief power in North Africa. Many European states paid large sums to buy freedom from the attacks of the corsairs, who carried on their evil ways till less than one hundred years ago.

The United States sent a fleet against them; and, at last, with the help of the English and the Dutch, matters improved; but it was not till 1830 that the French finally took Algiers and destroyed for ever the nests of the pirates. They set the captives free, and founded, after many difficulties, the French empire in Africa, which now spreads over the Central and Western Sudan, over the basin of the Niger, and along the western coast of the great continent. In Morocco, the most westerly of the Barbary States, live Moors, descendants of the Mohammedans who conquered it in the seventh century, Berbers, and numbers of Jews and negroes. Like Egypt, the country has a sultan at the head of the government. In name he has absolute power, but, in reality, part of the country is under the protection of France, and part under the protection of Spain. Morocco was for a long time in a very bad state of misrule, and France and Spain have undertaken to see that the government is carried on in an orderly manner.

Turkey in Africa, once very large, does not exist at all, as Italy has taken Tripoli, Tunis is under French protection, and the Sultan of Egypt is now

THE KING OF PORTO NOVO, IN DAHOMEY, PRESIDING OVER A COUNCIL OF HIS MINISTERS

independent of the Sultan of Turkey.

If we look at the map on page 4299, or make a map of Africa, marking the chief divisions, and set in each division little flags of the countries who own them, we shall gain a good idea of what is mean by "the scramble for Africa." Except in a few cases, as we have seen, the uncivilized black races and tribes have been unable to hold their country either against Arabs or white men. So when particulars began to be known about the vast interior, at a time when most European nations were desiring room to expand across the seas, they turned to "unoccupied" Africa, each seizing the parts that were most easy to annex. The flags make a gay fringe right round the coast of the great continent.

THE FLAGS OF THE NATIONS THAT FLY ALL ROUND THE AFRICAN COASTS

Let us start from Egypt, with its crescents and stars. Libya, formerly called Tripoli, flies the Italian flag; Tunis and Algeria show French flags, and stretch far south beyond the mountains into the Sahara. Some day the French hope to push a railway across the desert to their possessions on the Niger. Morocco has its own red flag, and that of Spain signals from Ceuta, the Southern Pillar of Hercules, to the Union Jack that flies on the rock of Gibraltar.

Spain also owns the Sahara coast from Morocco to Cape Blanco, where the enormous French West African possessions begin. The independent striped flag of Liberia, the state of freed slaves, waves on the coast of Guinea, surrounded by numbers of European flags, all marking the various divisions now owned by their countries. Then, on the Congo, we have French flags again marking out the territory reaching up to Lake Chad, that curious lake, sometimes as large as New Jersey and sometimes a swamp.

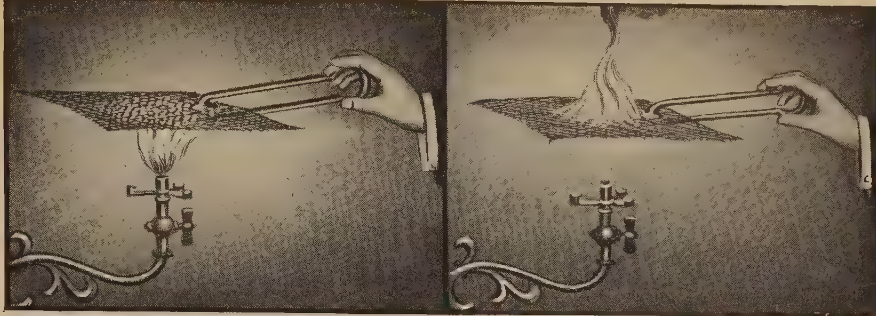
THE CONGO STATE, THAT IS NOW UNDER THE RULE OF BELGIUM

The Congo State, now under the rule of the Belgians, has only enough room on the coast to plant its flag, though it expands large and square in the interior. Angola is Portuguese; so is a long strip watered by the Zambezi on the east coast, opposite Madagascar, which from end to end is French. South of Angola lies what was German South-West Africa, until the World War. It is now governed by the Union of South Africa. The southern tip of the continent shows the British flag. German East Africa, with the three beautiful lakes of Nyassa, Tanganyika, and Victoria on its borders, is now called Tanganyika Territory, and is governed by the British. Kenya was formerly called British East Africa.

From Zanzibar, celebrated for its cloves, the caravans for the interior fit out; and many are the stirring adventures with slave-ships on this part of the coast. Italian flags wave on the horn of Africa, reaching up to the Gulf of Aden, where British Somaliland and French Somaliland separate Italian Somaliland from the Italian colony of Eritrea, which cuts off Abyssinia from the Red Sea. During the World War, the German possessions in Africa were taken from her by the nations allied against her. The Peace Conference decided that none should be returned, but that they should be managed by other countries, for the good of the people. These territories are said to be governed under a mandate. The changes are all shown on the map.

Railways have been begun by all the powers who now claim the right to govern Africa, and many miles of these railways have been built. This is a good thing for the natives, for enterprise like this strikes at the very root of the slave trade and the cruelties connected with the gathering of ivory and rubber; for rapid travel opens up dark places and draws together the great and varied interests of the huge continent. And it is this lighting up and linking up that alone will make it possible for Europeans to carry out the obligations they took upon themselves when they hoisted their flags over vast numbers of uncivilized natives in Africa. The trade of this vast country on either side of the railway is in its infancy, but great prospects are foreshadowed. These prospects can only be made realities by the people of the white races, and in doing so the temptation to oppress the weak and ignorant natives always exists. But this temptation must be resisted. If the wealth which lies in this great region is to be of real benefit to the world, part of it, at least, must in justice be spent in providing for the natives the education suited to their needs, and in raising them to a higher level of civilization, and bringing to them the blessings of peace and justice.

THE NEXT STORY OF COUNTRIES IS ON PAGE 4397.



These pictures illustrate the principle of the miner's safety lamp. If a piece of metal gauze be held over a gas-jet and the gas is lighted from below, the gas that has passed through the gauze and is on the other side will not ignite. If the gas be lighted from above, it will not ignite below the gauze.

HOW HEAT TRAVELS

CONTINUED FROM 4233

We know how heat travels by what is called convection and conduction, and now we may learn how these facts about heat were applied by a very famous Englishman, in what is called the safety lamp. This was invented about a century ago by Sir Humphry Davy, and it depends upon the fact that metals conduct heat quickly.

If we take a sheet of wire gauze and see what we can do with it to the flame of a gas-jet, we get some curious results. For instance, we can push the flame about by means of the piece of gauze, and if we hold the gauze a little distance from the gas-jet before we light the gas, we can make a flame burn on the side of the gauze away from the gas-jet, but that flame will not spread to the space between the gauze and the hole from which the gas is coming.

Now, the reason why the flame does not spread is that the gas only burns if it is hot enough, and the gauze is such a good conductor of heat that it takes up and spreads out along itself the heat made by the burning gas, so that the gas on the other side is not made hot enough and cannot burn. These facts applied in the safety lamp have saved countless lives. Davy's lamp is simply an oil-lamp which, instead of having a glass tube round the flame, has a tube or cylinder of wire gauze.

If coal-gas is in the air of the mine, it will pass through the gauze, and, when it is made hot enough by the flame, it will burn; but the flame of the coal-gas will not spread outside the lamp, because the wire gauze conducts the heat away so quickly that the coal-gas outside cannot take fire. Of course, when the miner notices the flame of the coal-gas burning inside his lamp, he will know that there is danger, and act accordingly.

Even with the safety lamp there is always a risk, for nothing is more generally true of mankind than that, in time, we grow accustomed to risks, and think no more of them. The consequence is that men become careless. The gauze of the lamp might be cracked or broken, and the miner might not trouble about it; his lamp might blow out, and he might strike a match to light it again.

Further, explosions in coal-mines are by no means due only to coal-gas; they are very largely due to coal-dust. For all these reasons, something better than the safety lamp is wanted. All proper mines are now lit by electricity, and no mine should be lit in any other way. This, of course, does not mean that we should pay any less respect to the great man whose simple device saved so many lives during so many years. We must now go back for a little

while to the other kind of heat, which is called *radiant heat.* We must do so because we are discussing the ways in which heat travels, and therefore, besides conduction and convection, we must mention *radiation*, these being its three ways of traveling. If a thing is hot enough, it is not only giving off heat by conduction to the air around it, but also, like the sun or a hot poker, it produces rays of radiant heat, and in so doing loses its own heat, for, of course, nothing comes from nothing.

Radiant heat, we know, consists of waves in the ether. Its laws are simple. First, it travels in straight lines, just like the very similar kind of radiation which we call light; secondly, radiant heat, like light, can be reflected from a surface, and is reflected according to the same laws as light; also, just as light is bent when it passes from air into water, so also is radiant heat.

THE LAWS OF RADIANT HEAT THAT ARE LIKE THE LAWS OF LIGHT

Knowing, as we do, that radiant heat and light are as like one another as the sounds produced by one octave of the piano are like the sounds produced by the next octave, we shall not be surprised that the laws of radiant heat are the same as those of light.

It is true of radiant heat and of light and of sound and of the action of gravitation and of the power of magnetism, that the force of them at any given point varies in a regular way according to the distance of that point from the source of the heat or light or sound, or whatever it is. A hot thing, or a bright thing, or a noisy thing, is one-fourth as hot or bright or noisy when its distance is doubled, one-ninth when its distance is trebled, and one-forty-ninth if its distance be made seven times as great as it was at first.

These are just instances, and we shall notice that 4 is 2 times 2; 16 is 4 times 4; 49 is 7 times 7. Now, when any number is multiplied by itself, the result is called the square of that number. So we see that the law in this case is that when the distance is increased, the power is diminished, not in proportion to the distance, but in proportion to the square of the distance. Instead of having one-seventh of the power when it is moved to seven times the distance, the hot thing, or whatever it is, has only one forty-ninth part of the power. This is not because anything is lost, but simply because the action of the thing we are trying is spread out more the farther it is away, and as the amount of this spreading out is the same in every case, we understand why the law should be true for heat, light, sound, gravitation, and everything else.

AN IMPORTANT LAW OF NATURE THAT GOVERNS HEAT

The proper way of saying this is that the intensity varies inversely as the square of the distance. The word inversely is put in to mean that the greater the distance, the less the intensity. If the intensity became greater as the distance became greater, then we should say that they varied directly instead of inversely—which, literally, means upside-downly.

We know very well that light will travel through certain things, such as glass, which we call transparent, and we should expect that just as certain things are more or less transparent to light, so things ought to be more or less transparent to radiant heat. The special name for this property does not matter. We may call it transparency to heat, and all we need now remember is that things may be transparent to light which are not transparent to heat, or they may be transparent to heat and not to light. For instance, water will let sunlight through, but it will stop altogether the radiant heat, which is really part of the sunlight, just as completely as the thickest and blackest shade would stop the visible light itself.

WHAT HAPPENS WHEN RADIANT HEAT CANNOT PASS THROUGH A SUBSTANCE

On the other hand, there are fluids which are almost quite transparent to radiant heat. Nothing, of course, is ever lost, and if the water is opaque to radiant heat—that is, if heat cannot pass through it—it does not mean that the radiant heat is lost. What happens is that the water becomes warm. If a fluid has the property of being transparent to radiant heat, then, in so far as it is so, it will not be made warm even in the blaze of sunlight. Different kinds of substances vary very much in their behavior as regards radiant heat. Just as water will stop and absorb radiant heat falling upon it, while other things will let the radiant heat through,

so one kind of thing will radiate heat from itself very easily and another will not. A great deal depends upon the surface of the thing, and, in general, dull surfaces absorb radiant heat more readily than bright surfaces.

WHY A THING CAN RADIATE ONLY WHEN ITS SURROUNDINGS ARE COOL

When we say that something is radiating, we assume that its surroundings allow it to radiate, and a great deal depends on these surroundings, and especially upon their temperature. A thing radiates only when its surroundings are cooler than itself; if its surroundings were hotter, it could not give heat to them, but they would have to give heat to it. The general rule is that the greater the difference in warmth, or temperature, between a hot radiating body and its surroundings, the greater is the rate at which it radiates and becomes cool.

We must hold fast to the truth that something is never obtained from nothing. Heat radiation, as we know, is a form of energy or motion in the ether. It is a kind of power. If it is produced by anything, that thing loses in proportion; therefore, every radiating body tends to become cool, and, sooner or later, unless new sources of energy are supplied to it, must become cooled down to the temperature of its surroundings, and then its radiant days are over.

These facts are of enormous importance in the great world of astronomy. When we come to study the different bodies of the solar system, we find how important are the laws of radiation. The moon, being very small, has not been able to hold its atmosphere to itself.

THE MOON'S RAPID CHANGES FROM HOT TO COLD AND FROM COLD TO HOT

The solid surface of the moon is naked and exposed to the sun's heat, and when the sun is playing upon any part of it, that part must become intensely hot. But when that same part is turned away from the sun, it begins to radiate back into space the heat it got from the sun. In so doing it soon becomes intensely cold. In other words, the fact that the moon has no atmosphere means that its surface is constantly being subjected to many very rapid changes of temperature. We cannot believe that life could possibly flourish under these conditions; and if it be true that there are traces of humble vegetable life upon the moon, that life must be protected from the violent changes of temperature by lying deep in shaded valleys where it is possible that a few traces of an atmosphere still remain.

Now let us consider the case of the earth. Like other bodies in the universe, the earth radiates its heat into space. The question is how far the atmosphere affects this radiation. The atmosphere, as we have already learned, is mainly made of two gases, oxygen and nitrogen; about one part of oxygen to four of nitrogen.

It has been found that both of these gases are very transparent to radiant heat; therefore, so far as they are concerned, the surface of the earth is almost as nakedly exposed to the sun's great heat as the surface of the moon is, and, on the other hand, can radiate away heat at night almost as readily as the moon is able to do.

HOW THE WATER-VAPOR IN THE AIR PROTECTS US FROM THE SUN'S RAYS

There is a most important gas in the air that we have not yet reckoned with, and that is gaseous water, or water-vapor, which is always more or less present in the atmosphere. We have already learned that liquid water is very opaque to radiant heat, and the same is true of water in all its forms. Therefore, the gaseous water in the atmosphere is, for one thing, a veil mercifully protecting us from the heat rays of the sun, and it is a barrier to the radiation of heat from the earth: both the heat of the earth itself and the heat which the earth is always getting from the sun. This influence of the water-vapor in the atmosphere is one of the most important of the many all-important services performed by water for life.

Lastly, let us consider the case of Mars. The measure and the changes of heat on the surface of Mars must depend to a very great extent upon its atmosphere, and upon the gases that make up that atmosphere. We have learned for certain, after many years of study and doubt, not that Mars has an atmosphere, for that was known, but that there is water-vapor in it. As in the case of our own earth—though to a less degree, for there is less

of it—this water-vapor must catch the heat of the sun, and must interfere with the loss of heat by radiation from the surface of Mars. All this bears very deeply upon one of the most interesting questions in the world—the question of the existence of life, and especially intelligent life, upon Mars.

The moon, the earth, and Mars, like the sun itself, and like all other bodies, small and great, which are hotter than their surroundings, lose heat by radiation, and, as we have often noticed before, the rate at which a body cools by radiation depends to a great extent upon its size. If we consider the case only of round bodies, the bigger they are, the greater is the amount of matter in them compared with the size of their surface, and, therefore, the more slowly they cool. Owing to this simple law affecting radiation, we can understand why the huge sun is far hotter than Jupiter, Jupiter hotter than the earth, the earth hotter than Mars, and Mars hotter than the moon, though, to begin with, the matter composing these different bodies was all of the same temperature.

RADIUM AND OTHER ELEMENTS THAT GIVE OFF HEAT WITHOUT BURNING

One of the most astonishing discoveries of recent times is that there are certain elements which give off radiant heat unceasingly, though they are not burning, though they are getting no heat from outside, and though they are not cooling down from a state of great heat. The best known of these elements is radium; but there is really quite a large number of them, all related in a regular way, and radium is merely one of the set. These *radio-active* elements, as they are called, have many wonderful properties, some of which we have studied; but one of the most remarkable is their power of ceaselessly producing heat, which they radiate out in all directions.

For several years after radium was discovered, the great question for science to answer was: Where in the world did this heat come from? A few rash and foolish people, not waiting to think, and eager to find fault with the work of those who think and study Nature, declared that radium upset the great law of the conservation of energy, which, as we know, says that nothing is added and nothing is destroyed, but that everything is changed. These people said that this law of the conservation of energy, which is for science the basis of all knowledge of the universe, was proved false, because here was an element, radium, which went on day and night without stopping, and made heat which, they declared, came from nowhere.

A LAW OF THE UNIVERSE TO WHICH THERE CAN BE NO EXCEPTION

Now, it is quite certain that if this were so, even only in this one case, and if the amount of heat made were ever so tiny, and if in the whole wide universe there were only just one-millionth part of a grain of radium that made heat out of nothing, then the law of the conservation of energy would not be true, and everything built upon it would have to come down.

Sometimes we say the exception proves the rule, but it all depends. In such a case as this, the tiniest exception that was a real exception would destroy the rule. Either the law of the conservation of energy is true altogether, or it is just an idle tale. If once it could be shown that the least portion of heat or anything else came from nowhere, was made out of nothing, everything we believe about the nature of the universe would have to be given up, and there would be nothing with which to replace it.

But we may forget those foolish people, whose only desire was to injure science, and who, like all who fight against truth, only injure themselves; and we must now ask: Where does this heat come from?—knowing that it must come from somewhere. Here there were great differences of opinion until more knowledge was obtained.

THE GREAT RADIUM MYSTERY THAT MEN TRIED TO SOLVE

One very great man thought, and many thought with him, that radium was able to get from the air—all the atoms of which are always dancing about—some of the power which that dancing about contains; and then they thought that the radium somehow transformed this energy obtained from the air into the heat which it gives out. But that theory, and also various other theories, which looked upon the radium as a transformer, pick-

ing up rays or waves or motion or something from outside, and turning the energy of them into heat, have all been completely disproved.

A DISCOVERY THAT HAS TRANSFORMED OUR IDEAS OF HEAT

It has now been proved that the radium finds the source of its heat in itself; the heat comes from the breaking down of the atoms of the radium, and these atoms are slowly being broken up into other kinds of atoms which contain less energy, as part of the energy inside the radium atoms themselves was given off in the form of heat when they broke down. This discovery of a source of heat inside atoms was utterly unsuspected by anybody until a few years ago, and is one of the discoveries which mark a new stage in the history of knowledge.

Few who study the subject can doubt that the time will come—and that not remotely, though perhaps not for hundreds of years—when mankind will be able to tap, so to speak, this energy inside the atom, and use it as a source of heat to keep him warm, to drive his ships, and to do work of every kind.

Before we go on to the question of the work done by heat, there is yet one more case of heat radiation, which is of very great importance, to those who live on islands or peninsulas, and which we ought to have in our minds as part of this subject. The facts of heat radiation, as they bear upon the sea, daily affect the lives of all of us who live on any island set in the silver sea. When men study climates in general, they find that there are, on the whole, two great classes of climate—the climate found in the heart of a continent, and the kind of climate found in islands. These are called by men of science continental climates and insular climates.

WHY THE SEASONS CHANGE SO GRADUALLY IN THE BRITISH ISLES

The English climate is insular, and, like all other insular climates, owes its special features to the presence of the water round the land. The chief marks of an insular climate, such as theirs, are, that it is a rather moist climate, and that the differences between the seasons are small and gradual compared with what we find in the case of our continental climate. The one word *equable* described this kind of climate in which summer is not too hot, winter is not too cold, and the changes from one season to another are not too violent.

Though the English always complain about the weather, they enjoy, in fact, perhaps the best example in the world of an insular climate, with all its great and many advantages for life of many kinds, and, above all, for human life. Britain would not have been Britain, and their forefathers would not have done what they have done for themselves and for us and for the world, were it not for the climate which so greatly favors the nurture of human life, and its best activities of every kind.

All this the islanders owe to the water which makes their land an island—to

> The silver sea
> Which serves it in the office of a wall,
> Or as a moat defensive to a house
> Against the envy of less happier lands.

WHAT THEY OWE TO THE WATER THAT SURROUNDS THE ISLANDS

An insular climate owes its virtues to the behavior of water shone upon by the summer sun. As we have seen, a great fact about water is that it is opaque to heat radiations, will not let them pass through, and by absorbing them becomes heated itself. That is what the sea does. As we shall learn, water can take in an enormous amount of heat with ease. This it does not only by absorbing radiations from the sun, but by conduction of heat from the air which is above it.

All through the summer the sea is growing warmer, partly by absorbing the radiations which strike it directly from the sun, and partly by the passage of heat into it from the air. This means that the air is cooled, and, being cooled, flows inwards over the land beneath the hotter air which is not yet cooled, as we have already learned it must.

Thus they owe to the sea their mild summer—how mild, they have no idea until they try to spend a summer in a climate that is not so kind as their own. What it amounts to is this: that in the summer there is too much heat, and the sea steadily takes up the excess, so that they do not suffer. That is very far from being all. Nothing is lost. The radiations which the sea absorbed

in the summer, and the other kind of heat conducted to it from the air above it, must all be accounted for. The first result is that the sea gets warmer and warmer through the summer.

WHY THE SEA IS HOTTEST WHEN THE SUN HAS LOST ITS GREATEST POWER

Everyone who bathes in the sea—and everyone should do so when he gets the chance—knows very well that the sea is not at its hottest on Midsummer Day, but several weeks later. It is not the third week in June that long-distance swimmers choose for their attempts, but the end of July and August, or even the beginning of September, long after the sun has lost its greatest power.

It was in August, 1875, that Captain Webb swam from Dover to Calais. For nearly twenty-two hours he was cleaving his way through the sea. In the end he felt the sands of Calais beneath his feet and staggered up the beach. Not until 1911 did any other man succeed in swimming across the English Channel. It is doubtful if any man could remain in the water for so long in May or June. The water is then too cold.

The sea gradually becomes warmer after Midsummer Day, and all the time it is making the summer bearable. But as the autumn advances, and winter begins to come, the sun greatly loses its power, and the laws of heat begin to work in another way. Heat must flow from the hotter to the colder—whichever be hotter and whichever be colder—and just as it had to flow from the air to the sea when the air was the hotter, so it must flow from the sea to the air when the sea is the hotter.

So all through the winter, but especially during the earlier half of the winter, the sea is pouring back to the air the heat which it stored up during the summer. The sea becomes very cold, as we find if we try to bathe in it, say, in the month of February; but the air is warmed, and so, just as summer was not too hot, winter is not too cold.

HOW THE CLIMATE OF BRITAIN DEPENDS UPON THE LAWS OF HEAT

Thus, the great features of British climate, with all that this means for the health and success of human life, and for the work of Britain for the world, depend upon the laws of the traveling of heat, especially upon the peculiar properties of water in absorbing heat radiations, and in being able to store almost any amount of heat. What it means to be surrounded at no very great distance by water, which absorbs radiant heat, we can best understand if we see what happens in other parts of the world where the state of things is different. Let us suppose, for the sake of the argument, that Britain remained just as it is, but that instead of the water around it there were put an extensive bank of dry sand.

Not many of us know from experience what the desert is, and what it means to live where the surface of the earth, instead of absorbing the sun's radiations, throws them all back to the air. If such a change were made around Britain, the whole face of the country would, in a short time, be utterly changed. The Britain of to-day would cease to exist, and a new country that no one could recognize would take its place. The summer would be intolerably hot, owing to the reflection of heat radiations from the desert sand, and owing to the fact that there was nothing to catch away and store up any of the radiant heat from the sun.

WHY THEY SHOULD NOT COMPLAIN OF THE COOLING AND REFRESHING RAIN

The British complain of the rain in the summer, but they may be thankful that they must not live through a rainless summer, merciless and shriveled, such as they would endure if they had sand instead of sea around them. On the other hand, when the winter came, there would be no rich stores of heat to be given up, so as to compensate for the lack of heat from the sun. Britain would cease to be Britain, and would disappear in a year or two with the disappearance of that climate which the British always abuse, but upon which their happiness and success as a nation depend.

So they owe more to the sea even than Shakespeare, and the British poets who have sung the sea since his time, remembered to tell, and perhaps now our British readers may even try to grumble a little less about the weather, and that will, at any rate, be something that they will have gained.

THE NEXT PART OF THIS IS ON PAGE 4389.

A GREAT ROMANCE OF ADVENTURE

ALEXANDER DUMAS, the celebrated romancer, who was largely inspired in his work by the example of the great Sir Walter Scott, based most of his famous stories on episodes from history, although he took great liberties with historical facts, and considered that the purposes of his tale were more important than the facts of history. Yet the greatest of his novels is one in which history plays practically no part at all. "The Count of Monte Cristo" is purely an effort of the imagination, and a more fascinating story was never conceived in the mind of a romancer. In its original form it is a work of enormous length, and takes one a great deal of time to read, though the time so spent is full of delight. Here we have endeavored to retell the story very briefly, but even so it will require twice the space of any of the others. Only the first part of the story is printed here; the second part begins on page 4431. "Monte Cristo" was originally published in 1844.

THE COUNT OF MONTE CRISTO

CONTINUED FROM 4228

THE three-masted ship Pharaon arrived at Marseilles from Smyrna, commanded by the mate, young Edmond Dantès, for the captain had died on the voyage. Edmond was a great favorite with the crew, to whom he was more like a brother than a superior officer, and his skill in seamanship was so unquestioned that the shipowner did not hesitate to offer him the command. A captain at nineteen, his increase of pay would enable him to make his old father comfortable, and it would also enable him to marry at once the dark-eyed Mercédès, who had been his sweetheart for three years.

Little wonder, when he had set foot in Marseilles, there was not a happier man in all the city. He seemed to walk on air. His wedding was arranged, and the guests invited to the feast. Everything was prospering so much with him that more than once he said his happiness was almost too great to last.

Edmond Dantès, being naturally of a frank and friendly disposition, never suspected he could have enemies. But what he innocently considered his good luck was the means of creating enemies against him. The supercargo of the Pharaon was an envious fellow named Danglars, who would have liked to command the vessel, so that he might profit dishonestly out of its trading. Fernand, the half-Spanish cousin of Mercédès, was deeply in love with the beautiful girl, and hated Edmond because he had won her heart. Here, indeed, were enemies enough if the young sailor had suspected them for one moment. But he counted these two among his friends.

It was a time of great political unrest. Napoleon, who had been lord of well-nigh all Europe, had surrendered his throne, and in the little island of Elba, which lies between his native Corsica and the coast of Italy, was plotting how he might regain his lost sceptre and revive his empire. The French throne was now occupied by Louis XVIII., the younger brother of Louis XVI., who had been beheaded during the Revolution in 1793. But the country was not satisfied with his rule, and, of course, the old veterans who had fought in the great wars of Napoleon, and all who were devoted to the idea of a great French empire, longed to see Napoleon back again.

All that was necessary to have a man cast into prison at that time was to denounce him to the public prosecutor as taking part in some plot to restore "the usurper," as Napoleon was named by the supporters of King Louis XVIII. Edmond Dantès had quite innocently come under the suspicion of being in treaty with Napoleon's grand marshal at Elba, for, in obedience to the last instruction of his dead captain, Edmond,

on his way home from Smyrna, visited the island of Elba, and, going ashore alone, received from the grand marshal an important letter, which he was charged to deliver personally to a gentleman in Paris.

Edmond was to hasten his wedding, and after the ceremony to set out upon a trip to Paris, during which he would make safe delivery of this letter.

HOW HIS ENEMIES PLOTTED AGAINST CAPTAIN EDMOND DANTÈS

But meanwhile Fernand's jealousy had taken such possession of his mind that his one wish was to get Edmond removed before he could marry Mercédès. In Danglars he found a willing conspirator, who saw how Edmond's visit to Elba could at least be used to have him arrested and put under examination. Caderousse, a tailor, was at first taken into the confidence of the conspirators, but, as he began to think it was a dangerous trick to play on the young captain, he advized the others against it.

While seeming to agree, the other two went forward with their secret denunciation of Edmond; and Danglars, who was present at the wedding festival, from which Fernand in great excitement had hastened away, had the wicked satisfaction of seeing poor Edmond arrested by a magistrate and marched off to the town-hall, when he was on the point of leaving the wedding feast to proceed to church with Mercédès for the religious ceremony.

THE LETTER THAT BROUGHT ILL-FORTUNE TO THE YOUNG SAILOR

The consternation among all the friends of young Dantès was almost stupefying. Knowing that he was too young to know much of politics, too frank and manly to be engaged in any secret scheme, too honest to be a smuggler, they were all at their wits' end to guess why he had been arrested.

His employer, Monsieur Morrel, who believed in him absolutely and was willing to take any personal pledge for his honesty, tried to comfort Edmond's old father and Mercédès by saying it must be some terrible mistake, and that son and bridegroom would soon be restored to them.

Edmond, when brought before M. de Villefort, the deputy public prosecutor, to be questioned in his private room, was utterly bewildered at what had happened, and the prosecutor could see quite clearly the transparent honesty and innocence of his prisoner. So sure was he that Edmond was not only innocent, but ignorant of all political feeling, that he fully intended to dismiss him, until his inquiries elicited the fact that the prisoner had been found in possession of a letter from Napoleon's grand marshal at Elba addressed to a gentleman in Paris. He looked among the articles taken from Edmond, and found the letter. It was addressed to one Noirtier; and on reading the name and address the whole appearance of Villefort underwent a sudden and terrible change.

Keenly and anxiously he now questioned Edmond as to what he knew of the letter, and was satisfied that the young man knew nothing beyond the name and address of the person to whom he had engaged to deliver it.

THE DOOM OF DANTÈS IS PRONOUNCED BY THE PUBLIC PROSECUTOR

Villefort opened and read the letter with further show of excited attention, and then, calling Edmond to witness that he burned it to ashes in the grate, he made him swear never to mention the name of the person to whom it was addressed. The public prosecutor was actually appealing to his prisoner!

Little did Edmond know the terrible struggle that went on in the bosom of the public prosecutor, who recognized the undoubted innocence of the prisoner but was tempted to safeguard his own private interests, which the prisoner might by an innocent word betray. For this Monsieur Noirtier, to whom the letter in Edmond's possession had been addressed, was none other than Noirtier de Villefort, father of Villefort. He was an ardent supporter of Napoleon, whereas his son was scheming for favor at the hands of the restored monarchy. The public prosecutor had found his father's Napoleonic sympathies so great a drawback to him that he had altered his name to avoid being associated with that of Noirtier.

The letter which Edmond had brought from Elba was to inform Noirtier that Napoleon in a few days would make another bid for the crown, and, landing in France, would summon his old legions to his banner. Villefort thought he saw in this knowledge a means of

advancing himself with the Government; but the fact that he had obtained information from a letter addressed to his own father would mean death to his father and be fatal to his own prospects if it should become known. None but Dantès knew of the letter. With him safely imprisoned, Villefort's course would be free. Thus was the doom of Edmond Dantès cast, and he was sentenced to imprisonment.

As we know from history, Napoleon landed, and made his last heroic stand, during the period called "The Hundred Days," which ended with his final overthrow at Waterloo. Monsieur Morrel, who was a supporter of the emperor, urged upon Villefort, when it seemed that Napoleon must again establish himself, to draw up a petition in favor of Dantès, begging his release on the ground of services rendered in Napoleon's cause, since it was on that ground he had been imprisoned under Louis XVIII., who had now fled from France.

THE INNOCENT YOUNG PRISONER IN THE TERRIBLE CHÂTEAU D'IF

Villefort willingly made the petition as strong as possible in favor of Dantès, dwelling on imaginary services in the Napoleonic cause, but did nothing with it beyond preserving it carefully among the documents in the town-hall, expecting that it would be a terrible weapon against Dantès when, as was not improbable, and as history records, Louis XVIII., came back to the throne.

The deputy public prosecutor had decided in favor of safeguarding his own interests even at the expense of dooming to a terrible imprisonment an innocent young man.

Poor Edmond was removed from the town prison and taken under a strong guard in a boat to the gloomy island fortress of Château d'If, a prison in the sea, whence no one had ever been known to escape.

A sullen and dirty-looking under-gaoler conducted him to a damp and dismal room almost underground where a lamp flickered on a stool, some fresh straw had been laid down for a bed, and a jug of water and a piece of coarse bread provided for refreshment.

As soon as the unhappy young man had passed within the door the gaoler took up the lamp, and, with a surly "Good-night," bolted in his bewildered prisoner. Dantès was alone in darkness and in silence, cold as the shadows that seemed to breathe on his burning forehead. At dawn the gaoler found him standing as he had left him, his eyes swollen with weeping. All his senses were numbed. The gaoler had to touch him before he realized his presence.

SIX YEARS WITHOUT HOPE IN A DARK AND NOISOME DUNGEON

He could not eat the food the man brought, and when at length his awful situation dawned upon his mind, he threw himself in despair on the floor, crying out bitterly against the inscrutable fate that had worked him such woe.

Some days passed and he had occasional words with the gaoler, demanding always to see the governor, which he was told was impossible, and finally saying he would kill the gaoler if he would not promise to let Mercédès know what had become of him.

The result of this threat of violence was that the prisoner was consigned to one of the dungeons of the castle, darker and damper than the room he had first occupied, and even more lacking in all means of escape.

So the days passed, the weeks grew into months, and the months went by without the prisoner having counted them. He had languished in his dungeon for well-nigh six years when he began seriously to think of how he might starve himself to death. He had refused all food for four days, and was growing very weak, when, about nine o'clock at night, he suddenly heard a hollow sound in the wall against which he was lying. It was like the continual scratching of a huge claw, a powerful tooth, or some metal instrument scraping against stone.

THE STRANGE SOUND THAT AWAKENED HOPE IN THE PRISONER'S HEART

Weak and exhausted as he was, he feared his brain might be deceiving him, but by careful listening he decided the noise was made by some one scraping against the stones of his dungeon wall. Wild thoughts of liberty leaped up within him. The noise was going on again when the gaoler brought his breakfast next morning, and, fearful lest the gaoler should hear it, Edmond became suddenly very talkative, so that the man thought him delirious, and brought

him some broth and white bread. His recent decision to starve to death was now suddenly abandoned. He greedily drank the broth to revive his strength for what might be required of him. He loosened a stone from the wall and struck three times with it against the wall whence the sound seemed to come.

THE UNKNOWN PRISONER MINING THROUGH THE CASTLE WALL

At the first blow the sound ceased, as if by magic. It was not heard again that day, and the night passed in silence also, so that he determined it was some prisoner cutting his way through to liberty.

All his anxiety now was to recover his strength. He no longer refused the food brought to him. The same sounds did not occur again, but after three days he felt certain the unknown prisoner was again at work, using a lever to move the stones instead of a chisel. Edmond determined that he, too, would try to cut a passage out, and perhaps join up with the other.

The only thing he could think of was to break his water-jug and conceal two or three of the fragments in his bed. With a piece of the broken jug he scraped away all night, removing the damp mortar around a large stone in the wall which was hidden when his bed was drawn against it. He seemed to make but little progress, but all night long he heard the subterranean workman continuing to mine his way.

In the morning the gaoler grumbled at the broken jug and fetched in another. After he had gone, it was with a new delight that the prisoner resumed the scraping away of the mortar.

DANTÈS CONTINUES HIS DESPERATE EFFORT TO GAIN HIS LIBERTY

He reproached himself for not having occupied himself in this way for years. He had now been six years in his dungeon, and what might he have done in that time had he not given way to utter despair?

In three days he had removed all the cement from the stone, but the stone itself he could not move without some sort of lever. His ingenuity, so long disused, suddenly became active again. He had noticed that his gaoler brought his soup in an iron saucepan with a strong handle, and for this he would now have given ten years of his life. How to get the saucepan with its handle to use as a lever for moving the stone was the next object of his thoughts. This he achieved by leaving his soup-plate on the floor, so that when the gaoler next came in he stepped upon it and broke it. The man had thus either to go upstairs again for another plate or to leave the pan containing the soup with the prisoner, and bring a new plate at his next visit. Happily, his natural laziness prompted him to leave the saucepan, and thus Dantès came into possession of the priceless instrument. Using its handle and toiling away all night, he made wonderful progress in loosening the stones of the wall. And as the gaoler forgot to bring him a new plate, still letting the saucepan serve the purpose of a plate, the prisoner had much longer use of it than he had dared to hope.

THE VOICE IN THE WALL AND WHAT IT SAID TO EDMOND DANTÈS

For the last three days he had heard no sound of the unknown toiler. But this was all the more reason why he should himself press on with his own work.

Day and night he toiled incessantly. The saucepan, of course, was carefully replaced, and its handle straightened before the gaoler appeared, so that he might suspect nothing.

But Dantès had burrowed no great distance into the wall when he came upon a mighty beam of wood which presented a dead end to the hole he had made. It would now be necessary for him to dig above or below it. The thought of such a task dismayed him. In his agony of mind he murmured aloud, beseeching God not to let him die in his despair.

"Who talks of God and despair at the same time?" said a voice that seemed to come from beneath the earth, and, deadened by the distance, sounded hollow and sepulchral in the young man's ears. Edmond's hair stood on end, and he rose on his knees.

"In the name of heaven," cried Dantès, "speak again, though the sound of your voice terrifies me!"

"Who are you?" said the voice.

"Edmond Dantès," replied Dantes, who made no hesitation in answering. "A French sailor."

"How long have you been here?

"Since the 28th of February, 1815."

"Of what are you accused?"

"Of having conspired to aid the emperor's return."

"How for the emperor's return? The emperor is no longer on the throne, then?"

"He abdicated at Fontainebleau, in 1814, and was sent to the island of Elba. But how long have you been here, that you are ignorant of all this?"

"Since 1811."

Dantès shuddered: this man had been four years longer than himself in that dreadful prison.

This strange conversation was continued much further, and Edmond gathered that only a few stones had now to be removed to join the tunnel of the other prisoner to the much smaller hole that he had made. The other tunnel was lower and came under the beam that had caused Edmond to despair. But alas! the heroic labors of the unknown worker had been in vain. With incredible toil he had been making his passage through the wall for years, and had burrowed a tunnel fifty feet in length, only to find that instead of leading, as he had hoped, to the outer wall of the castle, whence he would have flung himself into the sea, it led to the cell of another prisoner.

THE MEETING OF THE TWO PRISONERS AND THEIR NEW COMPANIONSHIP

Next day the other prisoner came back along his tunnel and made his way into Edmond's cell. They greeted each other with joy. For, at the worst, if they could continue to meet each other daily, some little of the bitterness of their captivity would be removed by their companionship. Edmond's new friend was a man who might have been sixty years of age. Though small of stature and very thin of face, with a long black beard, and hair that seemed to have been whitened by sorrow and suffering rather than age, he still showed considerable activity for one who had been so long imprisoned. His bright and active mind, and the healthy influence of the long task he had just finished, had helped to keep him in fit condition.

He told Dantès about the marvelous tools he had been able to make out of the scantiest material; how he had made his chisel from one of the clamps of his bedstead, and with this chisel had been able to cut the long tunnel in the wall. He examined Edmond's cell carefully, and climbing up by the help of Dantès to the loophole near the ceiling, he found that it looked upon a courtyard where sentries were on duty, thus cutting off all hope of escape.

"Then the will of God be done!" said the old man slowly; and an air of profound resignation spread over his careworn countenance. He then told Dantès that he was the Abbé Faria.

THE STRANGE STORY OF THE ABBÉ FARIA AND HIS LONG ENDURANCE

Previous to being transferred to the Château d'If, in 1811, he had suffered three years' imprisonment in another fortress. His crime had been to advocate a united Italy and to scheme for the making of a powerful kingdom out of the petty principalities into which his native land was divided at that time. This was treason to Napoleon's plans in 1807, and the abbé had been betrayed to the French.

Edmond's new friend was none other than the "Mad Abbé," though he showed no signs of madness and many of wisdom far beyond the ordinary man. Dantès was fascinated beyond expression by the abbé's account of his prison occupation, and asked him why he should not begin again, with him to help, to cut a passage which would lead them to the outer walls.

"In the first place," said the abbé, "I was four years making the tools I possess, and have been two years scraping and digging out earth, hard as granite itself; then what toil and fatigue has it not been to remove huge stones I should once have deemed impossible to loosen.

HOW THE ABBÉ HAD CUT HIS TUNNEL THROUGH THE CASTLE WALL

"Then, to conceal the mass of earth and rubbish I dug up, I was compelled to break through a staircase, and throw the fruits of my labor into the hollow parts of it; but the well is now so completely choked-up that I scarcely think it would be possible to add another handful of dust without leading to discovery. And just at the moment when I reckoned upon success, my hopes are for ever dashed from me. No, nothing shall induce me to renew attempts evidently at variance with the Almighty's pleasure."

Thus it was willed, and, as all hope

of escape was finally abandoned, the two prisoners sought by every means in their power to hide the evidence of their daily intercourse. It was now the abbé's pleasure to pass much of the time by instructing Edmond in those branches of knowledge in which he himself was skilled.

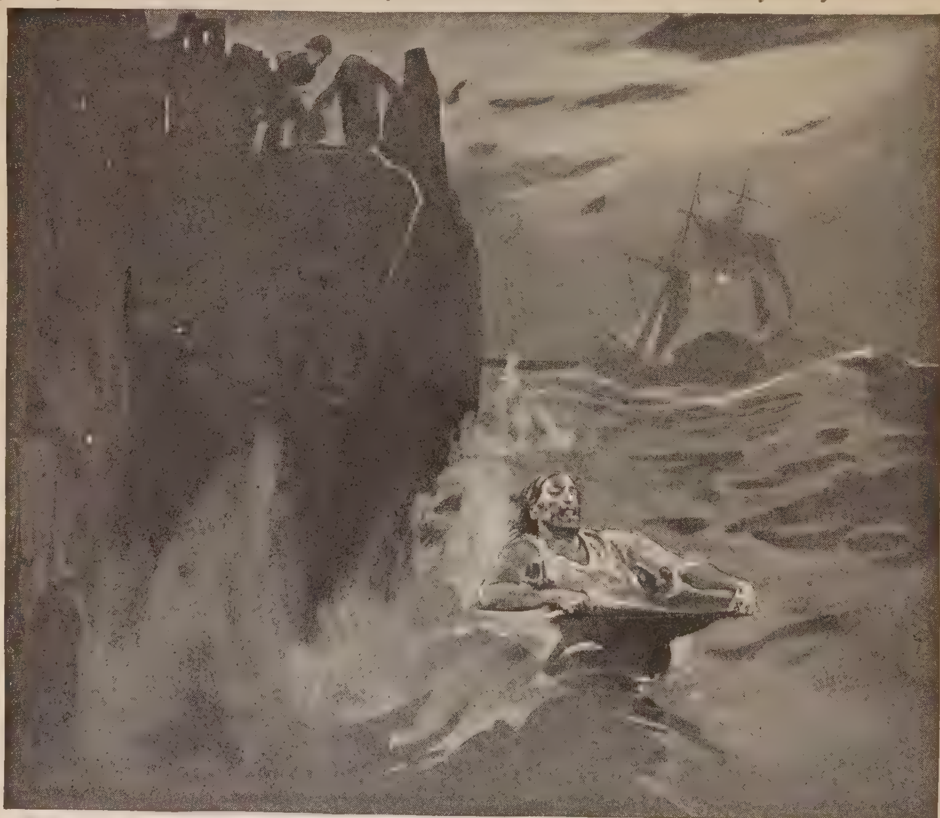
DANTÈS BECOMES THE EAGER PUPIL OF THE "MAD ABBÈ"

Edmond proved an apt pupil, and those long hours spent by the one in giving, and the other in receiving, knowledge of philosophy, history, science and languages brought to the lives of both a melancholy pleasure, which dulled the keen edge of their sorrow.

The abbé, by studying Edmond's case, was able to show to him that the enemy who had caused his imprisonment in the Château d'If could be none other than Villefort, in whom he had been greatly deceived. His own history the abbé related at length to his younger companion, and eventually, when his strength gave evidence of failing and a stroke of paralysis disabled one of his arms, he let Edmond into his great secret. It was this secret that had won him the title of the "Mad Abbé."

Before he had been arrested, the abbé had been secretary to the Count of Spada, the last of a famous race of Italian noblemen, who had died on December 25, 1807. It had come to the knowledge of the abbé during his association with the count that one of the Spadas of the fifteenth century, who was a cardinal, was poisoned, together with his nephew, by the agents of Cæsar Borgia, so that his immense fortune might come into the possession of the Pope and his friends.

But an extremely careful study of the history of all the famous people in Rome connected in any way with the



"THE SEA IS THE CEMETERY OF THE CHATEAU D'IF"

The most thrilling part of "Monte Cristo" is the story of Dantés' escape after fourteen years' imprisonment. Another prisoner had scraped a tunnel through the wall, only to find himself in the cell of Dantés. When the elder prisoner died, the gaolers put his body in a sack to throw it in the sea. But, creeping into the cell of his dead friend, Dantés removed the body and sewed himself in the sack. Thus he was thrown into the sea, and, ripping the sack up with his knife, he succeeded in swimming to a vessel, and so escaped.

Spadas of that time had proved to the Abbé Faria that no one seemed to have benefited by the deaths of Cardinal Spada and his nephew. The abbé judged from this that the cardinal had hidden his fabulous riches somewhere to prevent their falling into the hands of his enemies at Rome, and had arranged to let his nephew into his secret, but no one else.

For years had Faria searched among the documents of the Spada family in the hope of finding something in the nature of a will, but discovered nothing. At the death of his patron, the count, he inherited the library of that nobleman, with its famous mediæval breviary, or prayer-book, which had been one of the treasures of the Spadas. One night, requiring a light hastily, he groped about in the darkness for the breviary, recollecting an old piece of paper, brown with age, which had been used as a marker in it, probably for centuries. He considered this of no value, as it bore no writing, and put the end of it into the fire to light it. But, to his amazement, as it burst into flame he saw yellowish handwriting begin to appear upon it.

THE BURIED TREASURE IN THE ISLAND OF MONTE CRISTO

Immediately he extinguished the flame, though not before a considerable part of the paper had been destroyed. In great excitement he lighted his taper in the fire itself, and then examining the paper found that the action of the heat had brought out some writing traced originally in an ink which only became visible when held to the fire. This is what he read:

> This 25th day of April, 1498, be . . .
> Alexander VI. and fearing that not . . .
> he may desire to become my heir, and re . . .
> and Bentivoglio, who were poisoned . . .
> my sole heir, that I have bu . . .
> and has visited with me, that is in . . .
> island of Monte Cristo all I poss . . .
> jewels, diamonds, gems, that I alone . . .
> may amount to nearly two mil . . .
> will find on raising the twentieth ro . . .
> creek to the east in a right line. Two open . . .
> in these caves; the treasure is in the furthest a.
> which treasure I bequeath and leave en. . . .
> as my sole heir.
> 25th April, 1498. CAES.

Being thrust into prison soon after this discovery, the Abbé Faria had given almost endless study to the task of completing the unfinished lines. After many years his efforts had been rewarded with success. He had satisfied himself that the portion of the paper which was burned away had read thus:

> . . . ing invited to dine by his Holiness
> . . . content with making me pay for my hat
> . . . serves for me the fate of Cardinals Caprara
> . . . I declare to my nephew Guido Spada
> . . . ried in a place he knows
> . . . the caves of the small
> . . . essed of ingots, gold, money,
> . . . know of the existence of this treasure which
> . . . lions of Roman crowns, and which he
> . . . ck from the small
> . . . ings have been made
> . . . ngle in the second;
> . . . tire to him
> . . . AR SPADA.

The abbé explained at great length, and with much excitement, how he had come to solve the mystery of the burned paper, and his solution proved that on the island of Moñte Cristo treasure valued at something like thirteen millions of money awaited the lucky person who knew where to find it.

THE DEATH OF THE ABBÉ FARIA AND WHAT IT LED DANTÈS TO ACHIEVE

Dantès knew the island, which lies between Corsica and Elba. Indeed, he had once touched at it. It is a rock of almost conical form, probably thrown up originally in some volcanic disturbance. Dantès traced a plan of it, and the abbé gave him advice as to how he thought the treasure might be recovered. For poor Faria had now abandoned all hope of ever being free himself to search for the treasure of Monte Cristo. Since his paralytic seizure he feared his end was near, and wished that Dantès might know his secret in case he succeeded in escaping from the prison. It was not long, indeed, before the poor abbé died. Edmond was plunged into a new agony of mind at the loss of his friend, who had been more than life to him, and at the hopelessness of the future.

HOW THE TUNNEL IN THE WALL SERVED A GREAT PURPOSE

But his wits had sharpened in his years of intercourse with the marvelous man who had breathed his last in that terrible prison. He was no longer the simple-minded mate of the Pharaon, but a man of much learning, immense resource, and now rendered bold by his desperate situation.

Thanks to the tunnel between the two cells, Dantès was able to listen to all that passed in the cell of the dead abbé.

He gathered that there would be no ceremonies about the funeral, and that the body would be buried after sunset. When the doctor had certified that the abbé was dead, the gaolers brought a large sack, in which the body, divested of its clothing, was placed, and so left in the cell. Dantès now determined to make his great stroke for liberty. Just as the abbé in life had saved and succored him, so was he in death to provide the way of escape.

DANTÈS CONCEIVES A WONDERFUL AND DARING PLAN OF ESCAPE

Opening the sack, Edmond took out the dead body of his friend, and with slow and painful effort contrived to drag it through the tunnel to his own cell. Placing it in his own bed, with the face to the wall, he covered it with the rags he wore himself, so that when the gaoler came with his evening meal he might suppose the form in the bed to be Dantès asleep, as he often found him so. Edmond's next move was to take the place of the corpse in the sack, sewing himself in with the needle which had been one of the abbé's most ingenious tools. In his hand he held the dead man's knife, and with palpitating heart awaited events.

Slowly the hours dragged on, until at length he heard the heavy footsteps of the gaolers descending to the cell. With rude jokes about the "Mad Abbé," they lifted the sack, after some talk about "tying the knot," which puzzled Edmond at the time. He was placed on a bier, carried by two men, and after some further movements, which he did not understand, the party went forward, lighted by a man with a torch, through the castle passages, until they came to a door which was opened. As they passed through this, the noise of the waves were heard as they dashed on the rocks below.

HOW THE PRISONER GOT CLEAR OF THE TERRIBLE CHÂTEAU D'IF

They ascended five or six more steps, and then Dantès felt that they took him, one by the head and the other by the heels, and swung him to and fro. "One," said the turnkeys, "two, three, and away!" And at the same instant Dantès felt himself flung into the air like a wounded bird falling, falling with a rapidity that made his blood curdle. At last, with a terrific dash, he entered the ice-cold water, and as he did so he uttered a shrill cry, stifled in a moment by his immersion beneath the waves. Dantès had been flung into the sea, into whose depths he was dragged by a thirty-six-pound shot tied to his feet. The sea is the cemetery of Château d'If.

Dantès, although giddy, and almost suffocated, had yet sufficient presence of mind to hold his breath; and as his right hand held his knife, he rapidly ripped up the sack, extricated his arm, and then his body. But in spite of all his efforts to free himself from the bullet, he felt it dragging him down still lower. He then bent his body, and by a desperate effort severed the cord that bound his legs at the moment that he was suffocating. With a vigorous spring he rose to the surface of the sea, while the shot bore to its depths the sack that had so nearly become his shroud.

Dantès merely paused to breathe, and then dived again in order to avoid being seen. When he rose again, he was fifty paces from where he had first sunk.

DANTÈS FINDS THE TREASURE IN THE CAVE AND BEGINS HIS VENGEANCE

He then struck boldly out to sea, which was rising in a tempest of wind, and, fortunately, was picked up by a sailing vessel, to whose captain he explained that he was the only one saved from the crew of a Maltese boat that had foundered, and accounted for his long hair and beard by an ingenious story about a vow which had now expired. He learned that it was the 28th of February of the year 1829, so that it was fourteen years, day for day, since his arrest. He wondered what had become of Mercédès, who must believe him dead. Then his eyes lighted up with hatred as he thought of the three men who had caused him so long and wretched a captivity.

Now at liberty, and safe on board the sailing vessel bound for Leghorn, he renewed an oath of implacable vengeance against Danglars, Fernand, and Villefort. It was not long before he had discovered the secret cave in the island of Monte Cristo, with all its dazzling wealth, as the Abbé Faria had truly foretold. He now stood possessed of such means of vengeance as never in his wildest dreams had any innocent prisoner hoped to be able to command.

THE SECOND PART OF THE STORY OF "MONTE CRISTO" BEGINS ON PAGE 4431.

A bit of Labrador coast at Battle Harbor.

A FRIEND TO FISHER FOLK

DR. WILFRED THOMASON GRENFELL

ABOUT fifty years before the World War, a little boy ran barefoot along the Sands of Dee, visiting among the fishing-boats in the river mouth, wandering across the marshes, hunting the game-birds there, learning to know the ways of nature at first hand. His name was Wilfred Thomason Grenfell, and he lived in the old city of Chester, which had been built hundreds and hundreds of years before by the Romans.

Chester is in the western part of England, beside the River Dee, and only the river lies between it and Wales. There Wilfred and his brothers spent their childhood. Some of his great-grandfathers, in the exciting days of England's earlier kings and queens, had sailed the seas to defend the land from Spanish fleets. And other relatives, not so long before, had fought in India for British honor and glory. So this little lad, with the fearlessness and hardiness of a good soldier or a good sailor, faced discomfort without flinching and loved hard sport or adventure. Even when he was a very little boy, the storms and gales and tides sweeping across the river's mouth, taught him the dangers of the sea and the hardships of men who live in boats. Yet he never felt any terror of such a life; and a great part of his own manhood has been spent on rough waters where boats are often tossed about like playthings of the waves.

THE EARLY LIFE OF A HEALTHY ENGLISH BOY

Until he was fourteen years old, Wilfred lived and studied in the school kept by his own father, who was a very learned man as well as a generous and kind parent. For his mother the boy had great love and devotion. This is the tribute he has given in writing the story of his life: "My mother was my ideal of goodness. I have never known her speak an angry or unkind word. Sitting here looking back over fifty years of life, I cannot pick out one thing to criticize in my mother."

From home the lad was sent to Marlborough "College," a large university preparatory school, where he spent several years in work and play, boyish pranks and changing "hobbies." Every boy makes collections of some sort. Wilfred and one of his brothers collected birds, sea-

Copyright, 1921, by M. Perry Mills.

weeds, shells and flowers, making their own cases and mounting their own specimens. Wilfred's great specialties were butterflies and moths, while his brother's chief interest was in birds' eggs. The brothers were in different schools, but the holidays were spent at home together, sometimes with the added company of cousins and friends. When the time came for choosing his real work in the world, Wilfred, then a young man, began to study medicine in London.

Always fond of stiff physical exercise, the young medical student joined gladly in the athletic life of his university—cricket, football, rowing, hammer-throwing, etc. All his life his enjoyment in active, outdoor sports has been keen. Soon he found a new way of using his strength and his fine enthusiasm. When his honest, fair-dealing mind faced the question of what religion ought to mean to him, he decided that the life of Jesus Christ held out the best answer. This he would take as a guide for his own actions. Instead of a habit, religion then became for him "the real adventure of life." Without any thought of sacrifice or hardship for himself, he simply looked about to find some helpful use for the sort of things he could do. Before long he had started giving some of the street boys of London, gathered in his Sunday School class, a chance at athletic exercises. Then he found a way to take groups of them with him and his friends on the boating and camping trips that were his principal holiday recreation. There they learned to swim and to enjoy a simple life in the open. It was before the days of Boy Scouts and other such organizations.

THE YOUNG DOCTOR FINDS HIS LIFE-WORK AMONG THE FISHERMEN

In 1886, after passing his examinations, young Dr. Grenfell was asked to join in a new work for deep-sea fishermen on the North Sea. These men, living on their boats, were exposed to great dangers, and had little interest in their lives outside of the day's task. They were only too likely to spend their free time (and their money) in drinking on the grog boats that went along to sell them alcoholic liquors, or in low saloons on shore.

The plan for the new venture, the Mission to Deep-Sea Fishermen, was to fit out a little fishing-smack and send it among the fleets to offer the fishermen the services of a good doctor in case of accident or sickness. Then, too, they might find friendly companionship with the little company on board, and attempt simple religious services there.

You shall hear, in his own words, Dr. Grenfell's impression of his new experience. "These deep-sea fisheries," he says, "were a revelation to me, and every hour of the long trip I enjoyed. It was amazing to me to find over twenty thousand men and boys afloat—the merriest, cheerfullest lot which I have ever met. They were hail-fellow-well-met with every one, and never thought of deprivation or danger. . . . They were the nearest possible thing to a community of big boys, only needing a leader."

The work suited the young man, and he was just the one to fit the work. Life at sea gave him a chance to know the men and give them the understanding fellowship that they needed. A good fighter, too, when a fight is necessary, he showed his spirit in getting the better of the forces that worked against the welfare of his fisher friends. His nature delighted in the free, hardy ways of seafaring, and the direct approach of man to man. He had never "cared much for the frills of life," he tells us, so he did not feel the lack of them. Added to a wish to do what he could to make men whole and well in body, he had a deep purpose to help them become strong and splendid in every way. His straightforward Christian thinking and Christian living were just what would appeal to men who lived simply and saw things naturally. In fact, this sincere, cheery, hearty, athletic, fun-loving missionary doctor found his way straight into the hearts of men and boys wherever he went.

LIFE ON THE BLEAK COAST OF LABRADOR

The North Sea work had been going on for about five years, and growing all that time, when the way opened for a new and joyful adventure. At least that is what it seemed to Dr. Grenfell. He was asked to go across the Atlantic Ocean and carry to the fishermen of the cold seas along the western shores the same kind of help that he had been giving on the European side. It was the beginning of his own special life-work. Far-off Labrador did not know what a

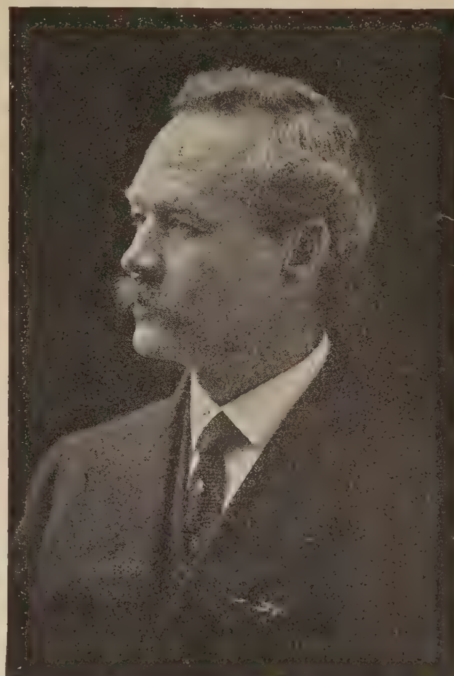
happy day for its future had dawned one morning in June of 1892. Perhaps that very day some child was born whose life would later be made full of health and usefulness through the doctor just starting from England to cross the ocean to find the children who needed him. Perhaps that very day some child or man or woman in the Labrador was dying in pain and want because there was no doctor, no help, no comfort to be had.

For it was a land of hard conditions, where every mouthful of food must be won by heavy labor and even the children must begin early to help at the tasks of catching, splitting and curing codfish, and working in the household. Grains will not grow there, so all cereal food has to be brought from a distance and bought with a price. Few vegetables can be raised because of the short, cool summer season. And, besides, the strong, wolf-like dogs that are so necessary for drawing loads, destroy any attempt at a garden if they can break into it. Neither will they leave pigs or sheep or hens alive. They really make it impossible to keep such live stock even if there were food for raising it. The sea is the source of most of the food for the inhabitants. Cod serves them for "bread and butter," we are told. There are Indians (busy in hunting deer and trapping fur-bearing animals), Eskimos, and descendants of British settlers who in one way or another drifted into these desolate ports. The last are called "liveyeres" because they say, "Oh, ay, zur, I lives yere!"

THE HARDSHIPS AND POVERTY OF THE FISHER FOLK

Across the ocean, then, Dr. Grenfell sailed, following the course that John Cabot had taken four hundred years earlier, and landing in St. John's Harbor, Newfoundland. From there he started again on a long northern cruise in Labrador waters and along the coast. What he saw you must read some day in his book, "A Labrador Doctor." Oddly shaped, towering icebergs, a hundred or more at a time, flashed rainbow colors across blue seas, where shoals of fish made silver streaks, and "great schools of whales, noisily slapping the calm surface of the sea with their huge tails as in an *abandon* of joy, dived and rose." Fjords, or high-cliffed inlets, wound in among the mountains. Birds and berries were some of them strange and some of them familiar. Bare giant jagged rocks were contrasted with deep growths of evergreen in river valleys. The air was full of life and sparkle.

And how about the people? They had no crowded cities, no large settlements even. Here and there were small groups of those who lived the year round on the Labrador coast, making a bare living by fishing, hunting and trapping. They must work very hard indeed in the summer fishing season to get enough fish



Dr. Wilfred Thomason Grenfell.

to exchange for their winter food and clothes. If they had bad fortune in the fishing, they often nearly starved (sometimes actually starved) before the springtime came. In winter they might catch fur-bearing animals whose pelts could be sold for supplies, but long, hard journeys by komatik (dog-sled) had to be taken to the nearest trading-posts to make the exchange. Seals must be killed to provide fat and food and skins for clothing. In fact, they were greatly needed for all three. For example, no other material than seal-skin will make shoes that properly protect the feet from Arctic cold. But, in later years, the poor folk of the coasts have had greater difficulty getting

seals enough, since great sealing parties, in large, strong vessels, despoil the seas each spring, carrying off the skins and leaving behind great waste of flesh that should have served for food.

THE GENEROSITY AND SELF-SACRIFICE COMMON IN THE NORTH

There is no ease for the dwellers in the Labrador. But they are a sturdy, cheerful, friendly sort of folk, ready to bear the burdens of life as they know it, and generous in sharing whatever they have. The flour may be low in the barrel, with no more to be had, and there may be left but a few drops of "the sweetness" (molasses); still, a needy neighbor or a chance visitor is welcome to take the best of what there is. Flour mixed with water and then fried, a little molasses, and a drink of tea, is not very good fare for hard workers in a cold country; but this sometimes has to serve for whole families, part of the winter. The homes that the doctor found were dark, damp, and uncomfortable. A whole family might be living in one room, with wooden bunks around the walls to sleep upon.

Sickness or injury, under such conditions, would bring the worst results. If a bone were broken or a gun explosion made a bad wound, there was no surgeon at hand to help. If illness came, there was no chance for medicine or good food and nursing. Sick folk "simply died or lived, as chance directed." Besides the families that make their homes entirely in the region, through the short summer season there is a larger floating population of fisher folk from farther south, who either live on their boats or come by the mail-boats and camp on the shores while they catch their fish and dry and salt them. They, too, often need a doctor's attention.

HOW THE WORK HAS GROWN AS THE YEARS HAVE PASSED

"Be you a real doctor?" was the question that greeted the newcomer on the Mission boat. "Us hasn't got no money, but there's a very sick man ashore, if so be you'd come and see him." About nine hundred patients Dr. Grenfell treated that first summer, and never since that time have the people had to go through a year without visits from skilful physicians with friendly hearts and hands. Indeed, they are inclined to think that any stranger must be a doctor. For year by year the work has grown. The second summer, a little hospital was started at Battle Harbor, on an island at the entrance to the Strait of Belle Isle, just between Labrador and the northern point of Newfoundland. Then another was added, for summer use, farther up the coast, at Indian Harbor. In the first years, Dr. Grenfell alone made the rounds, in a little launch with only three men. A fearless and able seaman, he shared the watches on board, even when tired by long service among his patients.

But, to reach more people and reach them more often, there had to be more workers. Dr. Grenfell's own eager interest and belief in the future of Labrador led friendly helpers from England, Canada and the United States to offer their time, and others to send their money. The doctor found that by spending his winters lecturing and writing, he could gain this useful help. The result is that there are several hospitals, with the best of doctors and kind nurses, ready to care for the folk on the bleak northern end of Newfoundland and the long Labrador coast. As long as the summer keeps the water open, boats carry workers north to far-away points where only the Moravian Brothers had done anything to help, before. They had been very good friends to the Eskimos there.

HOW THE HOSPITAL SHIP, STRATHCONA, MAKES ITS ROUNDS

Chief among the Mission's boats is Dr. Grenfell's hospital ship, the Strathcona, presented by Lord Strathcona. She is welcomed joyfully wherever she appears. Other smaller sailing-boats and launches go here and there, mostly manned by students who love to spend their vacations in this way. In the winter, journeys have to be made on dog-sleds over scrubby, snow-covered ground where it is not easy to find one's way, or over humpy ice in bays and alongshore. But away go the doctors, in clothes made to keep the heat in, and with "lassy pork buns" in their "nonny bags." These buns, made with molasses and containing chopped pork fat, are good, nourishing food and do not freeze. "Lassy seal buns" are made with seal blubber instead of pork. More than once have Dr. Grenfell and his assistants nearly lost their lives on their trips.

SUMMER TIME ALONG THE LABRADOR

Many fishermen who move north for the short summer fishing season in Labrador waters, live on their boats. But others live in such shelters as this low sod house, close, dark and damp, where diseases are unwelcome housemates. Their fish are spread on "stages" like the one at the left.

Have you a journey to go, or firewood to haul, or supplies to bring from a distance? From November until May in Labrador and Northern Newfoundland, you can do none of these things without a trusty dog-team. Feed them well, treat them kindly but firmly, then give each his place at the end of his trace and they'll sweep your sled over the snow. Here, a summer helper is feeding dogs at Forteau.

Pictures by courtesy of the Grenfell Association.

Once he spent the night on a loose ice-pan and had to kill three of his good dogs to keep himself from freezing.

A little story will show how much more than just physicians these doctor-friends are. In a remote hamlet where the winter was a bad one, the children were looking for Christmas cheer to come somehow, for they had been told by an old man, "Why, if Santa Claus is to get to Noo Yawk on time, he'm obliged to pass here early."

At the very right minute, one of the doctors dashed up on his dog-sled. "Come right in quick, Doctor," said the old man. "We're just looking for Santa Claus, and I don't know but what you's him."

THE PEOPLE ARE TAUGHT AND ENCOURAGED TO HELP THEMSELVES

The centre of the work is now at St. Anthony, on the northeast point of Newfoundland. A fine little hospital, a home for orphan children, a good school, an industrial house with carpenter and machine shops and other useful training departments — these are some of the things you would find at St. Anthony, once a wretched little settlement. The doctor's house stands on the hill. There his wife, his best helper, and his three children live. Near by, there is a guest house for visiting workers to live in. Children from the home have been sent to study at Pratt Institute, New York (where they have a scholarship), and in other places; then they have gone back to put their new training into use. They, with the help of volunteer workers, have brought about great changes in St. Anthony. Some of the buildings have steam heat. There are, too, an electric plant for lighting and other uses, and a water reservoir with unfreezing pipe supply for the houses. These things meant hard, hard work in that rocky land.

So far has the fame of the hospital spread that the mail-boats bring sometimes fifty patients at a time. As Dr. Grenfell said once, sometimes "the little waiting-room . . . at night resembled nothing so much as a newly opened sardine tin." The greatest of specialists often make long trips to give their best services to the sufferers of the sub-Arctic region. Eyes and ears and throats and bones can have as expert treatment as could be obtained in a great city. Here is a letter from a would-be patient:

"Dear Dr. Grandfield, when is the eye spider coming to St. Anthony? I needs to see him bad."

AN ATTEMPT TO INTRODUCE THE EUROPEAN REINDEER

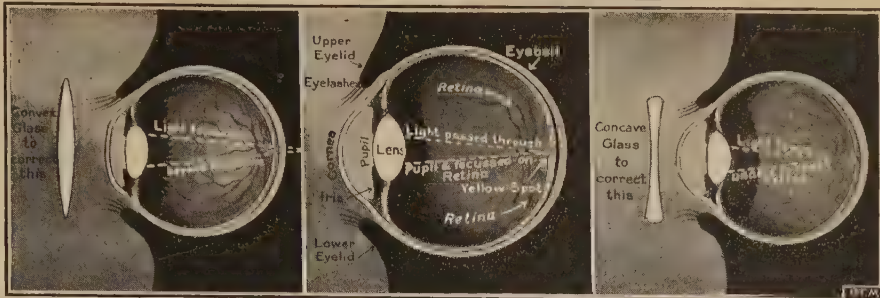
One of the most helpful changes made by Dr. Grenfell's efforts is the system of co-operative stores which has taken the place of the old plan of "trucking" in the trading places. By that plan a family's whole catch of fish or furs would be passed over to the trader in exchange for provisions. In bad seasons, the supply would be advanced, to be paid for by a future catch. Thus a debt was formed that sometimes was passed along from father to son. The new stores have been built up by the people themselves, urged and assisted by Dr. Grenfell. Shares are owned by the members, payments are in cash, and often there are profits to be divided. Out of seven or eight such stores, most have been very successful.

In one place, a sawmill has given the people a new way of improving their condition. One by one, the good changes have come about. An experiment with reindeer brought from Lapland has been tried—to provide milk, meat and clothing as well as means of travel—but as yet it has not proved all that had been hoped. Unfortunately, when a man's family was hungry, he thought it better to shoot a reindeer in the guarded enclosure and so get food at once, rather than to wait until the animals had increased enough to supply every one. In this way many of the little animals were killed off too soon.

LIBRARIES HELP TO DISPEL THE MONOTONY OF THE LONG WINTER

One other kind of help that has been started in those far-scattered settlements is the distribution of books. Again St. Anthony is the central point. Visiting librarians have given time to planning the collection and arrangement of the books. Boxes of fifty or a hundred volumes are carried out on the Mission boats, to be dropped at different points and picked up the following year. They are heartily welcomed.

Although he has not sought rewards and honors, honors have come to the modest doctor of the Labrador. Several universities in England and America have given him their degrees, and it was with the Harvard Surgical Unit that he served in France during the war.



In the middle picture we see a section of a perfect eye, with the light focused correctly on the retina. The left-hand picture shows an eye in which the cornea is too flat, and the light being focused beyond the retina causes indistinct vision. The cornea of the eye on the right is too convex.

THE PARTS OF THE EYE

CONTINUED FROM 4264

WHEN we examine the eye, the first thing we notice is that the front of it is transparent. This round, transparent part in front is called the *cornea*, which really means the horny thing. If we look very carefully at it, we shall see that it bulges forward somewhat. The curve of it is not quite the same as the general curve of the eyeball. This shape of the cornea is very important because of its effect on the rays of light that enter it. It acts just like the curved surface of the eye-cell of a leaf.

The first and greatest business of the cornea is to be perfectly transparent. It contains, therefore, no blood-vessels, small or great; it would not do to have red or white blood-cells in the cornea interfering with the passage of light. But the cornea is alive and must be fed, and it is supplied by materials that pass to it through the walls of the tiny blood-vessels that we find all round its edge. The cornea is well supplied with nerves, nearly all of which run to its front surface, in order that it shall be very sensitive.

This is necessary so that the least speck of dust, or anything else that would injure it, shall be felt and wiped away by the eyelids and the tears. Only too often, however, a workman gets what he calls a "fire" in his eye, and then there is a great risk that, when the cornea recovers from the injury, the injured place will be opaque for the rest of his days. Also, when anything of this kind happens to the cornea, blood-vessels grow into it from the side. They must do so, for they must supply food and other materials to the injured part, if it is to recover; but these blood-vessels mean that the passage of light is interfered with.

Only a short time ago, the first successful attempt that has ever succeeded was made to remove a piece of cornea that had become opaque, and to graft there a piece of healthy transparent cornea. It is well for us to understand how important and wonderful this part of the eye is. All the light we see by must pass through it; yet it is a living thing, with all the needs and delicacy of a living thing—very different from a curved piece of glass. Lastly, it is very much exposed, though, as we know, the eyelid, eyelashes, eyebrow, and the bony wall around the eye do their best to protect it from injury.

All round its edge the cornea passes into the white, thick, strong coat of the eyeball; indeed, the cornea is really a special part of this strong outer coat of the eyeball that has been made transparent, and has been made to bulge forward a little in order to help in focusing the light.

The white outer coat of the eyeball is very strong, and will stand a good deal of pressure. If we feel one of our own eyes with the finger, we shall find that it is quite tight; and the existence of this pressure in the eyeball, which is supported by the outer coat, is of great importance for good seeing.

Now, when we look at anyone's eye, we see something through the transparent cornea. We see a round, colored ring with a black hole, small or large, in the middle of it. The colored part is called the *iris*, and it is a ring of muscle with a hole in the middle of it, which is the pupil. This looks black because it is really the hole leading into the dark chamber, or inside of the eye, which is like the inside of a camera. Now, if we could be shown an eye cut through sideways, we should see that there is quite a large space between the cornea and the front of the iris. This space is filled with a watery fluid, and the light has to pass through this fluid before it is able to reach the pupil.

THE PUPIL OF THE EYE THAT GROWS BRIGHT IN A DIM LIGHT

The business of the iris is to regulate the size of the pupil. The less the amount of light, the larger must the pupil be; and the more the light, the smaller the pupil. So when a person goes from darkness into light, or when the eyes are opened in a bright light, anyone may see that the pupil grows smaller. We can also notice that the pupil gets smaller if a person who has been looking at something far away suddenly looks at an object close to his eye. There is a special reason, rather difficult to explain, why it improves the clearness of vision to reduce the size of the pupil when looking at something near. The cause is to be found in the shape of what lies behind the pupil, as we shall soon see.

All the color of the eye is due to the iris. The color is not to be found at all in the muscle fibres that make the iris; they are just like other muscle fibres, and are the same in everybody. But both on the back and front of the iris there is a layer of cells, which may or may not contain a certain amount of pigment, or paint. It is this that varies in different people. It is interesting from the point of view of beauty, because its variations in different people provide many different types of beautiful eyes. But the color of the iris has quite lately become most interesting, because we have learned what are the rules as to the way in which eye-color descends from parent to child. This is one of the subjects which is being closely studied by scientific men all over the world, and we are no doubt going to learn a great deal from it.

THE PEOPLE WITH BLUE EYES AND THE PEOPLE WITH BROWN EYES

It seems that some eyes have brown pigment in the cells on the front of the iris, and others have not. This gives us at once two great types of eyes—those which have the brown pigment on the front being more or less brown, and those which have not being more or less blue. There is far more to say than this, of course, because, as everyone knows, there are many different blues and browns, and many eyes which could not be called either. But still we have already learned that a father and mother with genuine blue eyes never have brown-eyed children; on the other hand, if one parent has brown eyes and the other parent has blue eyes, most of the children, at any rate, will have brown eyes.

At present, in America, it seems quite plain that blue eyes are rapidly becoming rarer and brown eyes commoner. One of the deeply interesting questions is as to why this is so, and what the consequences will be. Careful study of the iris in thousands of people in all parts of the country, and especially the study of the eyes of children as compared with their parents, will teach us not only a great deal about heredity, as it is called, but will also help us to learn what is really happening, and how far it is true that the blue-eyed strain in the population is dying out and the brown-eyed people surviving.

THE PEOPLE WITH BLUE EYES WHO ARE DISAPPEARING FROM THE WORLD

It is very likely that though the blue-eyed seem less able to bear city life, and the conditions of existence nowadays, they probably may have many valuable qualities, and their slow disappearance threatens to be a great loss to the world, and ought to be thoroughly investigated, and some means found to check it.

Now, if we pass through the door in

the iris, we find a beautiful transparent thing called the *lens* of the eye. It is a genuine lens, just like the lens of an ordinary magnifying glass, and it is of the same shape, convex on both sides. It helps to bend the rays of light entering the eye, just as the cornea did, and it is perfectly transparent. Unlike any lens that any man ever made, this lens, while able to do all that artificial lenses do, can do far more; for it is elastic, and can change its shape as we please.

HOW THE LENS OF THE EYE IS KEPT INSIDE A LITTLE BAG

The lens lies inside a little bag, and that bag has little fibres attached to it all round, which can be pulled upon by tiny slips of muscle inside the eye. When the bag is pulled upon in this way all round, the lens inside it is made flatter. When the muscles stop acting and the pulling ceases, the lens is free to bulge out again if it is perfectly elastic.

It is by this power of the lens that we are enabled to see clearly both at short distances and at long distances. Now, as everyone knows, in the case of an ordinary camera, it is equally necessary to focus the light properly if the picture to be taken is to be sharply defined on the plate; or if we are using a magic lantern, we know that we must focus properly if the picture is to be sharply thrown on the screen. In these cases, and in all other cases where men use artificial lenses—as, for instance, in the microscope and the telescope—the same method of focusing is employed, and that is to alter the distance of the lens, or lenses—for there may be several—from the place where we want the image to fall.

HOW OUR EYES FOCUS BY CHANGING THE SHAPE OF THEIR LENSES

It is very interesting to discover that in the fishes this method, which men employ in all their instruments, is employed in the eye: the lens has its position shifted nearer to or farther from the *retina*, or screen, at the back of the eye. But in all the higher types of eye, such as our own, this method is not employed. There is no arrangement for shifting the lens backwards and forwards in order to suit the distance of the particular thing at which we are looking. Its distance from the retina is fixed. The method of the higher types of eye is not to alter its position, but to change its shape where it stands. That is why it has to be most perfectly elastic, so that after it has been flattened, by having the bag in which it lies pulled upon, it can spring back perfectly to its rounder shape.

This means that the shape of the eyeball, as a whole, is very important. An eyeball may be long from back to front, and then the lens is far from the retina, or it may be short from back to front, and then the lens is nearer the retina. If the lens be of the same shape in the two cases, one eye or both must certainly not be quite suited to its purpose. Thus, in consequence of the varying shapes of eyeballs, the variations in the curve of the cornea, and the variations in the shape of the lens itself, we find that there are a very large number of people whose eyes are not perfectly suited for all kinds of use.

SHORT-SIGHTEDNESS HAS NOTHING TO DO WITH THE HEALTH OF THE EYE

Nothing is more important than for us to understand, at the very first, that this is not at all a question of the health of the eye. An eye may be healthy or ill, like any other part of the body, but what we are now talking about is simply a question of the mere shape of the eye or certain parts of it. The bending of rays of light is called *refraction*, and so we usually speak of "errors of refraction" to describe those cases where an eye is short-sighted or long-sighted, or has some defect of that kind.

This has nothing to do with the health of the eye or of any other part of the body, except that, as we shall see, if something is not done, the rest of the body may be affected. We are to look upon the eye for the moment as a kind of optical instrument or machine and simply to realize that the shape of this optical instrument will affect the rays of light that pass through it, just as in the case of any other optical instrument.

It is very commonly found that the cornea is not quite regularly curved; it bulges more or less in one direction, say, from side to side, than it does in another direction, say, from top to bottom. This means that, if we are looking at a cross, the one limb of it cannot be seen sharply if the other is. As a rule, this defect in the shape of the cornea is so slight that

it is not worth bothering about; but often it is worth while to wear glasses which are more curved in one direction than in another—more curved in the direction in which the cornea is less curved, and less curved where the cornea is more curved—so that the little defect is corrected. This particular error of refraction is not nearly so important as those we must now study.

WHY IT IS THAT SOME PEOPLE BECOME SHORT-SIGHTED

Short-sightedness is what happens when the eyeball is rather too long from back to front. This error of refraction means that the light is focused before it reaches the retina, and when it does reach the retina the picture it makes is rather blurred. Sometimes, also, short-sightedness may be due to the cornea being too much curved, so that it acts as too strong a lens, and the rays of light are focused too soon.

Short-sightedness is a very common defect, and is very inconvenient. We can see anything near quite well; the things farther off are blurred. The reason why we see things clearly when they are quite near, and why we therefore always hold a book close to our eyes, is that, when a thing is held close, the eye catches the light rays from it as they are spreading out.

If they are spreading out when they reach the eye, they are not so likely to be focused too soon; but if the thing is farther away, then the rays coming to it from the eye are not spreading out, or divergent, as we say, but are parallel, and will be too easily focused for the convenience of an eye that is too long from back to front.

THE NUISANCE OF BEING SHORT-SIGHTED WHEN PLAYING GAMES

The short-sighted person is at a disadvantage in recognizing people, and also in playing games. It is a nuisance to have to wear glasses to see clearly at any distance; but, on the other hand, he suffers no injury if he wears no glasses, and his eyes are very well suited for work at short distances, such as reading and writing, looking after machinery, sewing, and, indeed, nine-tenths of all the work that is done by civilized people to-day. People who start short-sighted when they are quite young, or who even are long-sighted at first—as most young children are—often become gradually more and more short-sighted until the age of, perhaps, thirty. Most of the people who study this subject are very sure what the cause of this is, only, unfortunately, they do not agree with each other.

Some of them who have not really gone into it properly think that the short-sightedness is a sort of disease of the eye, and is due to over-use of it, bad conditions during childhood, and so forth. Others think that it is a natural change which is bound to happen in any case; and still other people suppose that this increase in short-sightedness is due to the constant use of the eye at short distances.

The truth lies somewhere between the last two opinions; each of them is probably true in part. The eye, like other parts of the body, does undergo natural changes during life, and as it gradually becomes more long-sighted after a certain age, quite apart from anything that is done to it, there is no reason why it should not become more short-sighted during the earlier years.

HOW SHORT SIGHT IS CAUSED BY USING THE EYE FOR SHORT DISTANCES

On the other hand, we can prove that, when the eye is used for short distances, certain muscles inside it are used in such a way as to tend to make the eyeball longer from back to front, and therefore more short-sighted.

The reason for going carefully into this is that very few people understand the facts, and many doctors even have not properly inquired into them. Young people between the ages of twenty and twenty-five find, very often, that year by year they get rather more short-sighted; perhaps they require to use glasses for games where formerly they did not need them, and the glasses have to be made stronger and stronger; or parents find their children beginning to require glasses for short sight, and every couple of years or so the glasses have to be made stronger.

People are alarmed if they think that all this means a kind of disease of the eye, or if they begin to ask themselves where this is going to stop. That is why everyone should understand that short sight is not a disease at all; that the changes which go on are natural; that they only go on to a certain point.

More than this, it is certain that we may look upon short-sightedness in our time as a kind of adaptation to our needs—that is to say, in the case of the great majority of people who have to use their eyes at short distances. For such distances the short-sighted eye is just the best that one can have; it lasts splendidly, and does not tire.

SHORT-SIGHTED PEOPLE MAY BECOME LONG-SIGHTED AS THEY GROW OLD

After a certain age, perhaps about forty-five, or later, the eyes, after having remained just as they were for many years, begin slowly to become long-sighted, or less short-sighted, as the case may be. But before we look at this we must return to the case of the child.

Practically all very young children are long-sighted. A certain number of them remain long-sighted as the years go on, and are still long-sighted when they begin to learn to read and write. There is no more disease or ill-health here than there is in the other case, but simply the eyeball is too short from back to front, the cornea is too flat, and so the rays of light are not focused sharply in time, and reach the retina sooner than they should. The retina is too near the lens.

Now, in days that are gone this was no serious matter, because people lived far more natural lives than they do now; perhaps we should say far more animal lives than they do now; but that is a difficult question. Anyhow, they lived much more in the open air. Instead of constantly reading books at a few inches distance, they had to read the book of the distant clouds and mountains; they had to see animals or enemies at great distances, and the use of their eyes for short distances was only occasional.

THE DIFFERENT USES FOR WHICH NATURE HAS FITTED DIFFERENT EYES

When the eye is to be used at long distances, evidently the long-sighted eye has little to complain of. It is as well off as the short-sighted eye is in the kind of life that most of us are living nowadays.

The time may yet come when, before we decide what to make of our children, we may care to ask ourselves the question: What has Nature made them for? Perhaps, for instance, other things being equal, we should think twice before we sent the long-sighted boy to a desk rather than to sea or to Europe. Meanwhile, however, our general idea is that all children are just the same, and require just the same treatment, and the long-sighted child is treated just like the other. But, whatever we do in this way, it is certainly our business to see that we do not hurt him in the process. We do hurt him, and it is easy to show why.

The long-sighted eye, we have said, is too short from back to front. The rays of light are not focused in time. Now, if such an eye is to be used at short distances, it will be very much strained, because the muscles inside the eye will constantly be trying to change the shape of the lens in order to make the eye focus better; in fact, the long-sighted eye requires to use the muscles inside it in all circumstances. This means that it is liable to get tired, and every long-sighted person knows what it is to get headache and eye-strain from the use of the eyes under conditions which would not be at all inconvenient or disturbing to a short-sighted person.

THE FOOLISHNESS OF MAKING CHILDREN USE THEIR EYES IN A WRONG WAY

In our ignorance and carelessness regarding children, and in the very foolish way that we pretend to educate them, we at present inflict very grave cruelty, and perhaps often injury that is never recovered from, upon large numbers of children everywhere by compelling them to use long-sighted eyes for purposes to which they are not suited.

All over the country, children are straining their eyes at reading and writing, gaining no good, but only harm, from what we do for them, and all they need is a pair of spectacles with rounded convex lenses that will help to focus the rays of light quickly, so that they are brought sharply together by the time they reach the retina at the back of these short eyes. It is the short eye, we must notice, that is long-sighted, and it is the long eye that is short-sighted.

We have just begun to discover how important this subject is, and, now that it is slowly occurring to us that before we begin to educate a child we must make it fit to be educated, we may

hope that, within a very few years from now, no long-sighted child will be allowed to be injured for the lack of spectacles costing a few dollars. The relief obtained when proper glasses are employed is quite astonishing.

As we shall readily understand, it is concave lenses that are used in spectacles for the short-sighted eye, and convex lenses that are used in spectacles for the long-sighted eye. We may think this out for ourselves.

As people become elderly the eye becomes more long-sighted; this change oftenest occurs at some time after forty-five. If the person was short-sighted, he now becomes less so. Indeed, if we take the whole course of life, there can be no doubt that, under ordinary modern conditions, the short-sighted person is much better off than the long-sighted person, although at first it may not appear to be the case.

THE LENS OF THE EYE THAT CEASES TO BE ELASTIC AND CAUSES LONG SIGHT

The long-sightedness of elderly people is due to changes that occur mainly in the lens of the eye. The all-important elasticity of the lens becomes impaired, and it does not bulge, when the pressure of its coat is removed, as readily as it used to do; indeed, it becomes decidedly flatter. In extreme old age the lens loses its elasticity to such an extent that its shape cannot be changed at all.

The commonest sign that the eyes are beginning to show this change is that the person finds it more difficult to read in a dim light. It is very much better to be sensible about this and wear glasses than to try to fight against it. This does no good, and, on the other hand, it may do just the same kind of harm as is done to the long-sighted child that is "educated," as we call it, without having glasses provided for him. The same is true in this case, as we have already seen, that people suppose the need for glasses to be a sign of weakness or disease, and so they think they ought to fight against it.

Now, it is good to fight against weaknesses, and there is not much hope for people who do not; but, if we understand the facts, the weakness is in being too proud to wear glasses or too careless. Of all the many evils from which mankind suffers, there are very few more unnecessary, more easily and cheaply relieved, than those due to errors of refraction in the eye, which we have just been briefly studying.

WHY MANY GREAT MEN OF THE PAST BECAME BLIND

In old age, or sometimes before it, the lens of the eye may become opaque. Much the commonest form of this misfortune is found in old age, but there is also a very definite form which may occur in quite young people, and which is known to appear in a regular way in parents and children. *Cataract* is the name applied to opaqueness of the lens. Its consequence is blindness. The time was, and that quite recently, when there was no remedy for this terrible affliction.

We know that many of the very great men of the past became blind in their old age, and in many cases it was cataract that was the cause. Nowadays science triumphs over this calamity. Thanks to those who have studied the structure of the eye, and thanks to Pasteur and Lord Lister, who have taught us how to keep microbes away from wounds, so that they shall heal easily and painlessly and certainly, it is now possible simply to make a little cut in the eye, then a little cut in the coat of the lens, and then, by a little squeeze, to push the lens out through the cut which was made—and there it lies in the surgeon's hand, looking almost like a little lens of ground glass.

This would probably have to be done to both eyes, though it makes all the difference in the world if it were done to only one eye when both were affected. It is easily done, without pain. The obstacle to the light is now gone, and the light can pour through to the retina; but the rays are not focused, and things cannot be properly seen.

HOW SCIENCE IS ABLE TO GIVE SIGHT TO THE BLIND

The remedy is to supply the person with spectacles, with strong convex lenses that take the place of the lenses he has lost. Few operations, so simple and so easy and so certain, do so much for old people, and it would be worth while to study the eye, if only to learn how it is possible, by the application of our knowledge, to give sight to the blind in this way, as is done all over the civilized world many times daily.

THE NEXT PART OF THIS IS ON PAGE 4425.

A FAMOUS AMERICAN POEM

THIS poem made the name of the American poet, Edgar Allan Poe, famous throughout his own land and widely known throughout Europe and the English-speaking world. When we read "The Raven," we seem to feel the anguish of a strong and loving nature to whom a dear one has but lately been lost. But this is entirely a work of imagination, not of personal feeling. The poem was first suggested to its author by his reading some verses entitled "Isadore," in which the refrain was, "Thou art lost to me for ever, Isadore." "Isadore" was written by an American author, long since forgotten, to express the emotion he imagined one would feel at the loss of a loved one, not because he was really in sorrow. Thus Edgar Allen Poe's world-famous poem was suggested to him by a poem which was also purely an effort of imagination. The raven he introduced from having been impressed by Grip in "Barnaby Rudge," and sought thus to invest the strange bird with more dramatic and mysterious interest.

THE RAVEN

CONTINUED FROM 4190

ONCE upon a midnight dreary, while I pondered, weak and weary,
Over many a quaint and curious volume of forgotten lore—
While I nodded, nearly napping, suddenly there came a tapping,
As of someone gently rapping—rapping at my chamber door.
" 'Tis some visitor," I muttered, "tapping at my chamber door—
Only this and nothing more."

Ah, distinctly I remember, it was in the bleak December,
And each separate dying ember wrought its ghost upon the floor.
Eagerly I wished the morrow—vainly I had sought to borrow
From my books surcease of sorrow—sorrow for the lost Lenore—
For the rare and radiant maiden whom the angels name Lenore—
Nameless here for evermore.

And the silken, sad, uncertain rustling of each purple curtain
Thrilled me—filled me with fantastic terrors never felt before;
So that now, to still the beating of my heart, I stood repeating,
" 'Tis some visitor entreating entrance at my chamber door—
Some late visitor entreating entrance at my chamber door—
This it is and nothing more."

Presently my soul grew stronger; hesitating then no longer,
"Sir," said I, "or Madam, truly your forgiveness I implore;
But the fact is I was napping, and so gently you came rapping,
And so faintly you came tapping—tapping at my chamber door,
That I scarce was sure I heard you" —here I opened wide the door—
Darkness there and nothing more.

Deep into that darkness peering, long I stood there, wondering, fearing,
Doubting, dreaming dreams no mortal ever dared to dream before;
But the silence was unbroken, and the stillness gave no token,
And the only word there spoken was the whispered word, "Lenore!"
This I whispered, and an echo murmured back the word, "Lenore!"—
Merely this and nothing more.

Back into the chamber turning, all my soul within me burning,
Soon again I heard a tapping, somewhat louder than before.
"Surely," said I "surely that is something at my window lattice;
Let me see, then, what thereat is, and this mystery explore—
Let my heart be still a moment, and this mystery explore—
'Tis the wind and nothing more."

Open here I flung the shutter, when, with many a flirt and flutter,
In there stepped a stately Raven of the saintly days of yore.
Not the least obeisance made he; not an instant stopped or stayed he;
But, with mien of lord or lady, perched above my chamber door—
Perched upon a bust of Pallas, just above my chamber door—
Perched and sat, and nothing more.

Then this ebony bird beguiling my sad fancy into smiling,
By the grave and stern decorum of the countenance it wore,
"Though thy crest be shorn and shaven, thou," I said, "art sure no craven,
Ghastly, grim, and ancient Raven, wandering from the Nightly shore—
Tell me what thy lordly name is on the Night's Plutonian shore!"
Quoth the Raven, "Nevermore."

Much I marvelled this ungainly fowl to hear discourse so plainly,
Though its answer little meaning—little relevancy bore;
For we cannot help agreeing that no living human being
Ever yet was blessed with seeing bird above his chamber door—
Bird or beast upon the sculptured bust above his chamber door,
With such name as "Nevermore."

But the Raven, sitting lonely on the placid bust, spoke only
That one word, as if his soul in that one word he did outpour.
Nothing further then he uttered; not a feather then he fluttered—
Till I scarcely more than muttered, "Other friends have flown before—
On the morrow *he* will leave me, as my Hopes have flown before."
Then the bird said, "Nevermore."

Startled at the stillness broken by reply so aptly spoken,
"Doubtless," said I, "what it utters is its only stock and store,
Taught from some unhappy master, whom unmerciful Disaster
Followed fast and followed faster till his songs one burden bore—
Till the dirges of his Hope that melancholy burden bore
Of 'Never—nevermore.' "

But the Raven still beguiling all my sad soul into smiling,
Straight I wheeled a cushioned seat in front of bird and bust and door;
Then, upon the velvet sinking, I betook myself to linking
Fancy unto fancy, thinking what this ominous bird of yore,
What this grim, ungainly, ghastly, gaunt, and ominous bird of yore
Meant in croaking "Nevermore."

This I sat engaged in guessing, but no syllable expressing
To the fowl whose fiery eyes now burned into my bosom's core;
This and more I sat divining, with my head at ease reclining
On the cushion's velvet lining that the lamp-light gloated o'er,
But whose velvet violet lining, with the lamp-light gloating o'er,
She shall press, ah, nevermore!

Then methought the air grew denser, perfumed from an unseen censer
Swung by Seraphim whose footfalls tinkled on the tufted floor.
"Wretch," I cried, "thy God hath lent thee—by these angels He hath sent thee
Respite—respite and nepenthe from thy memories of Lenore!
Quaff, oh quaff this kind nepenthe, and forget this lost Lenore!"
Quoth the Raven, "Nevermore."

"Prophet!" said I, "thing of evil!—prophet still, if bird or devil!—
Whether Tempter sent, or whether tempest tossed thee here ashore,
Desolate, yet all undaunted, on this desert land enchanted—
On this home by Horror haunted—tell me truly, I implore—
Is there—*is* there balm in Gilead?—tell me—tell me, I implore!"
Quoth the Raven, "Nevermore."

"Prophet!" said I, "thing of evil!—prophet still, if bird or devil,
By that Heaven that bends above us—by that God we both adore—
Tell this soul with sorrow laden if, within the distant Aidenn,
It shall clasp a sainted maiden whom the angels name Lenore—
Clasp a rare and radiant maiden whom the angels name Lenore."
Quoth the Raven, "Nevermore."

"Be that word our sign of parting, bird or fiend!" I shrieked, upstarting—
"Get thee back into the tempest and the Night's Plutonian shore!
Leave no black plume as a token of that lie thy soul hath spoken!
Leave my loneliness unbroken!—quit the bust above my door!
Take thy beak from out my heart, and take thy form from off my door!"
Quoth the Raven, "Nevermore."

And the Raven, never flitting, still is sitting—still is sitting
On the pallid bust of Pallas, just above my chamber door;
And his eyes have all the seeming of a Demon's that is dreaming,
And the lamp-light o'er him streaming throws his shadow on the floor;
And my soul from out that shadow that lies floating on the floor
Shall be lifted—nevermore!

THE HOUSEKEEPER

This quaintly humorous description of the snail was written by Charles Lamb, and it is in simple verses such as these that we can detect the kindly, gentle feeling of the poet, and his sympathy with the lowliest creatures of God's creation.

THE frugal snail, with forecast of repose,
Carries his house with him where'er he goes;
Peeps out—and if there comes a shower of rain,
Retreats to his small domicile again.
Touch but a tip of him, a horn—'tis well—
He curls up in his sanctuary shell.
He's his own landlord, his own tenant; stay
Long as he will, he dreads no quarter day.
Himself he boards and lodges; both invites
And feasts himself; sleeps with himself o' nights
He spares the upholsterer trouble to procure
Chattels; himself is his own furniture,
And his sole riches. Wheresoe'er he roam,
Knock when you will—he's sure to be at home.

AHAB MOHAMMED

There are many beautiful stories in the history of the Arabian rulers, and most poets have at some time or other turned to the rich legends of the East for inspiring themes. Few of these stories are more attractive than that of "Ahab Mohammed," which an American poet, named James Matthew Legaré, has set in this becoming dress of verse.

A PEASANT stood before a king, and said:
"My children starve, I come to thee for bread."
On cushions soft and silken, sat enthroned
The king, and looked on him that prayed and moaned,
Who cried again: "For bread I come to thee!"
For grief, like wine, the tongue will render free.
Then said the prince with simple truth: "Behold
I sit on cushions silken-soft, of gold,
And wrought with skill the vessels which they bring
To fitly grace the banquet of a king.
But at my gate the Mede triumphant beats,
And die for food my people in the streets.
Yet no good father hears his child complain
And gives him stones for bread, for alms disdain.
Come, thou and I will sup together—come!"
The wondering courtiers saw—saw and were dumb:
Then followed with their eyes where Ahab led
With grace the humble guest, amazed, to share his bread.
Him half-abashed the royal host withdrew
Into a room, the curtained doorway through.
Silent behind the folds of purple closed,
In marble life the statues stood disposed;
From the high ceiling, perfume breathing, hung
Lamps rich, pomegranate-shaped, and golden-swung.
Gorgeous the board with massive metal shone,
Gorgeous with gems arose in front a throne:
These through the Orient lattice saw the sun.
If gold there was, of meat and bread was none,
Save one small loaf; this stretched his hand and took
Ahab Mohammed, prayed to God, and broke:
One half his yearning nature bid him crave,
The other gladly to his guest he gave.
"I have no more to give," he cheerily said:
"With thee I share my only loaf of bread."
Humbly the stranger took the offered crumb,
Yet ate not of it, standing meek and dumb;
Then lifts his eyes—the wondering Ahab saw
His rags fall from him as the snow in thaw.
Resplendent, blue, those orbs upon him turned;
All Ahab's soul within him throbbed and burned.
"Ahab Mohammed," spoke the vision then,
"From this thou shalt be blessed among men.
Go forth—thy gates the Mede bewildered flees,
And Allah thanks thy people on their knees.
He who gives somewhat does a worthy deed,
Of him the Recording Angel shall take heed.
But he that halves all that his house doth hold,
His deeds are more to God, yea, more than finest gold!"

SPEAK GENTLY

This is a very old lesson in conduct, which has seen service in many children's books for fifty years or more. We can scarcely dignify it with the name of poetry, but as moral teaching in rhyme it is still worthy of repetition. Usually printed without the name of its author, it was most probably written by David Bates, an American poet, who lived and worked in Philadelphia about the middle of the last century.

SPEAK gently!—It is better far
To rule by love than fear—
Speak gently—let not harsh words mar
The good we might do here!

Speak gently!—love doth whisper low
The vows that true hearts bind;
And gently Friendship's accents flow—
Affection's voice is kind.

Speak gently to the little child!
Its love be sure to gain;
Teach it in accents soft and mild,
It may not long remain.

Speak gently to the young, for they
Will have enough to bear;
Pass through this life as best they may,
'Tis full of anxious care!

Speak gently to the aged one,
Grieve not the careworn heart;
The sands of life are nearly run,
Let such in peace depart.

Speak gently, kindly to the poor—
Let no harsh tone be heard;
They have enough they must endure,
Without an unkind word!

Speak gently to the erring—know
They may have toiled in vain;
Perchance unkindness made them so;
Oh! win them back again!

A LIFE LESSON*

James Whitcomb Riley was one of the most charming of all the American poets, and none, except the late Eugene Field, many of whose pieces have appeared in our book, has equaled him in his poems of child-life. The following, however, is not exactly a children's poem, but is a tender little study of one who grows up to meet unhappiness, and a reminder that the joys this world takes away are small compared with those the truly religious life has to offer us.

THERE, little girl, don't cry!
They have broken your doll, I know;
And your tea-set blue,
And your playhouse, too,
Are things of the long ago.
But childish troubles will soon pass by.
There, little girl, don't cry!

There, little girl, don't cry!
They have broken your slate, I know;
And the glad, wild ways
Of your schoolgirl days
Are things of the long ago;
But life and love will soon come by—
There, little girl, don't cry!

There, little girl, don't cry!
They have broken your heart, I know;
And the rainbow gleams
Of your youthful dreams
Are things of the long ago;
But heaven holds all for which you sigh—
There, little girl, don't cry!

*From "Child Rhymes," copyright, 1899. By special permission of the publishers, The Bobbs-Merrill Co.

THE WORK OF THE POETS

Arthur O'Shaughnessy, the author of these dreamy verses, was born in 1844. He became an assistant, first in the library, and afterwards in the natural history department of the British Museum, and died in 1881 at the early age of thirty-seven. From this poem we may learn that he held the very highest opinions of the poet's mission and influence.

WE are the music-makers,
  And we are the dreamers of dreams,
Wandering by lone sea-breakers,
  And sitting by desolate streams;
World-losers and world-forsakers,
  On whom the pale moon gleams:
Yet we are the movers and shakers
  Of the world for ever, it seems.

With wonderful deathless ditties
  We build up the world's great cities,
And out of a fabulous story
  We fashion an empire's glory:
One man with a dream, at pleasure,
  Shall go forth and conquer a crown;
And three with a new song's measure
  Can trample an empire down.

We, in the ages lying
  In the buried past of the earth,
Built Nineveh with our sighing,
  And Babel itself with our mirth;
And overthrew them with prophesying
  To the old of the new world's worth;
For each age is a dream that is dying,
  Or one that is coming to birth.

THE GLADNESS OF NATURE

American poets have largely found an abiding pleasure in singing the praises of wood and river, and William Cullen Bryant yielded to none in his willing homage to Nature. His devotion is proved by the many touches in this poem that show how closely he observed all things, from a dancing leaf to a flying cloud, from the twittering wren to the jovial beaming sun. The hang-bird, or hang-nest, as it is often called, builds a nest like a huge pear turned upside down, or sometimes like an open cup, hanging on the branch of a tree.

IS this a time to be cloudy and sad,
  When our mother Nature laughs around;
When even the deep blue heavens look glad,
  And gladness breathes from the blossoming ground?

There are notes of joy from the hang-bird and wren,
  And the gossip of swallows through all the sky;
The ground-squirrel gaily chirps by his den,
  And the wilding bee hums merrily by.

The clouds are at play in the azure space,
  And their shadows at play on the bright-green vale;
And here they stretch to the frolic chase,
  And there they roll on the easy gale.

There's a dance of leaves in that aspen bower,
  There's a titter of winds in that beechen tree,
There's a smile on the fruit, and a smile on the flower,
  And a laugh from the brook that runs to the sea.

And look at the broad-faced sun, how he smiles
  On the dewy earth that smiles in his ray,
On the leaping waters and gay young isles—
  Ay, look, and he'll smile thy gloom away.

A POET'S LAST THOUGHTS

Like other hapless sons of the muses, John Clare, who was born in the county of Northampton in 1793, went through many hardships. During a great part of his life his lot was that of a farm laborer, and long before he died, in 1864, his mind was unhinged. His fate will account to some extent, if not altogether, for the sadness of the following lines by him.

I AM! yet what I am who cares, or knows?
  My friends forsake me like a memory lost.
I am the self-consumer of my woes;
  They rise and vanish, an oblivious host,
Shadows of life, whose very soul is lost.
  And yet I am—I live—though I am toss'd

Into the nothingness of scorn and noise,
  Into the living sea of waking dream,
Where there is neither sense of life, nor joys,
  But the huge shipwreck of my own esteem
And all that's dear. Even those I loved the best
Are strange—nay, they are stranger than the rest.

I long for scenes where man has never trod—
  For scenes where women never smiled or wept—
There to abide with my Creator, God,
  And sleep as I in childhood sweetly slept,
Full of high thoughts, unborn. So let me lie—
The grass below; above, the vaulted sky.

THE SANDPIPER

Here is another instance of Nature worship on the part of an American poet. Celia Thaxter, who was born in 1836 and died in 1894, had a narrower range than her more distinguished compatriot Bryant, but yet warbled sweetly her native woodnotes wild. She was especially fond of the sea, perhaps because her father was for many years keeper of a lighthouse. The sandpiper is a lively little shore-bird that flits about from point to point in search of shell-fish.

ACROSS the narrow beach we flit,
  One little sandpiper and I;
And fast I gather, bit by bit,
  The scattered driftwood, bleached and dry.
The wild waves reach their hands for it,
  The wild wind raves, the tide runs high,
As up and down the beach we flit—
  One little sandpiper and I.

Above our heads the sullen clouds
  Scud black and swift across the sky;
Like silent ghosts in misty shrouds
  Stand out the white lighthouses high.
Almost as far as eye can reach
  I see the close-reefed vessels fly,
As fast we flit along the beach—
  One little sandpiper and I.

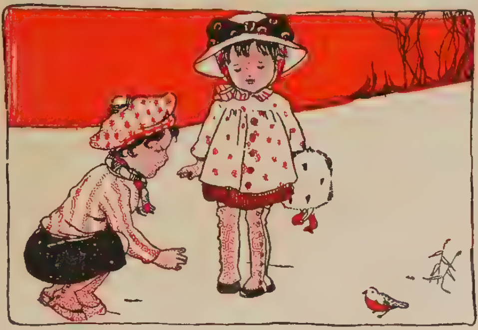
I watch him as he skims along,
  Uttering his sweet and mournful cry.
He starts not at my fitful song,
  Or flash of fluttering drapery.
He has no thought of any wrong;
  He scans me with a fearless eye.
Stanch friends are we, well tried and strong,
  The little sandpiper and I.

Comrade, where wilt thou be to-night
  When the loosed storm breaks furiously?
My driftwood fire will burn so bright!
  To what warm shelter canst thou fly?
I do not fear for thee, though wroth
  The tempest rushes through the sky:
For are we not God's children both,
  Thou, little sandpiper, and I?

*Published by permission of D. Appleton & Co.

LITTLE VERSES FOR VERY LITTLE PEOPLE

WHEN the snow is on the ground,
Little Robin Redbreast grieves;
For no berries can be found,
And on the trees there are no leaves.



The air is cold, the worms are hid;
For this poor bird what can be done?
We'll strew him here some crumbs of bread,
And then he'll live till the snow is gone.

"WILLY boy, Willy boy, where are you going?
I will go with you, if that I may."
"I'm going to the meadow to see them a-mowing,
I'm going to help them make the hay."

NOW what do you think
Of little Jack Jingle?
Before he was married
He used to live single.

THE gossips of the village—see,
Their fine lace caps are wearing.
They sip their dainty cups of tea,
White sugar they are sharing.

Their fingers shine with golden rings,
But—duty never matters!
Nothing is ready for the men,
And under—they are tatters!

HUSH-A-BYE, babby, lie still with thy daddy,
Thy mammy is gone to the mill
To get some wheat, to make some meat,
So pray, my dear babby, lie still.

A DUCK and a drake,
And a nice barley cake,
With a penny to pay the old baker;
A hop and a scotch
Is another notch,
Slitherum, slatherum, take her!

PUSSY sits beside the fire,
How can she be fair?
In comes the little dog,
"Pussy, are you there?
So, so, Mistress Pussy,
Pray, how do you do?"
"Thank you, thank you, little dog,
I'm very well just now."

THE white dove sat on the castle wall,
I bent my bow and made her fall;

I picked her up, feathers and all,
And I rode away from the castle wall.

"LEND me thy mare to go a mile."
"She is lamed, leaping over a stile."
"Alack, and I must keep the fair—
I'll give thee money for thy mare."
"Oh, oh, say you so!
Money will make the mare to go."

HE loves me, he don't!
He'll have me, he won't!
He would if he could,
But he can't, so he don't!

I LOVE you well, my little brother,
And you are fond of me;
Let us be kind to one another,
As brothers ought to be.
You shall learn to play with me,
And learn to use my toys;
And then I think that we shall be
Two happy little boys.


Two little kittens, one stormy night,
Began to quarrel and then to fight;
One had a mouse and the other had none,
And that's the way the quarrel begun.

"I'll have that mouse," said the biggest cat.
"You'll have that mouse? we'll see about that!"
"I will have that mouse," said the eldest son.
"You sha'n't have the mouse," said the little one.

I told you before 'twas a stormy night,
When these two little kittens began to fight;
The old woman seized her sweeping broom,
And swept the two kittens right out of the room.

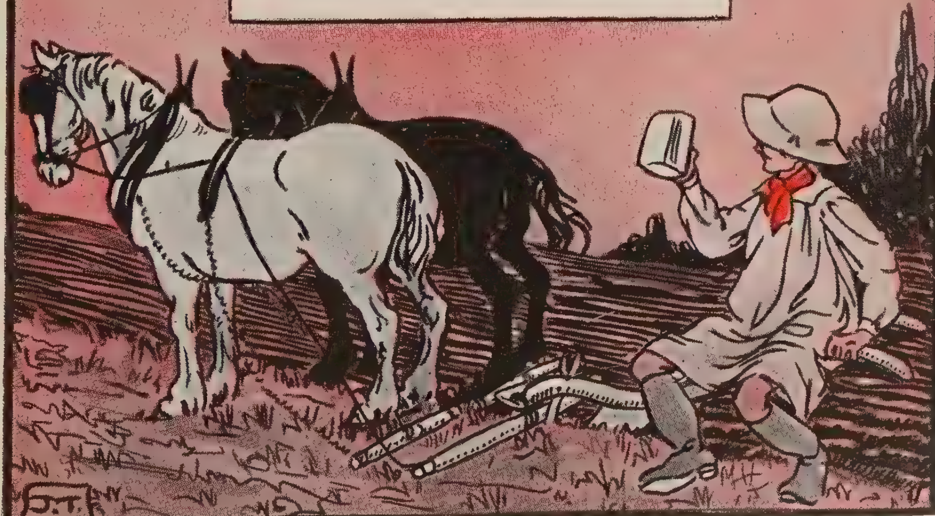
The ground was covered with frost and snow,
And the two little kittens had nowhere to go;
So they laid them down on the mat at the door,
While the old woman finished sweeping the floor.

Then they crept in, as quiet as mice,
All wet with the snow, and as cold as ice,
For they found it was better, that stormy night,
To lie down and sleep than to quarrel and fight.

Wassail! Wassail all over the town,
Our toast it is white, our ale it is brown,
Our bowl it is made of the good mapletree;
We be good fellows all — and I drink to thee.

Here's to Grey Dobbin, and to his right ear,
God send our master a happy new year!
A happy new year as e'er he did see,
With my wassailing-bowl I drink to thee.

Here's to Black Beauty, and to his right eye,
God send our mistress a good Christmas pie;
A good Christmas pie as e'er I did see —
With my wassailing-bowl I drink to thee.



THE PRINCE GOES ON HIS TRAVELS

The Prince had five servants, by whose help he won the Princess—the tall man, the fat man, the man with wonderful ears, the man with wonderful eyes, and the man who shivered in summer and was hot in winter.

THE PRINCE'S FIVE SERVANTS

CONTINUED FROM 4286

MANY, many years ago there lived a beautiful Princess, who was so charming that everyone loved her. But, in spite of all the love and admiration that was showered upon her, the Princess was not happy, for she had a very cruel mother, who never seemed so happy as when she was making others miserable.

It can easily be understood that with such a Queen the Palace was by no means the most agreeable place to live in, and the Princess eagerly looked forward to the day when some brave Prince would fall in love with her, and take her away to a home of her own. But, alas! no sooner did a suitor appear than the old Queen set him, as the price of her daughter's hand, some impossible task, on the understanding that failure should mean his death; and so the poor man lost not only his bride, but his head as well.

One day, when the Princess was walking in the forest with her maids, idly wondering whether there could be another being in the whole wide world so wretched as she was, a handsome Prince rode by.

"What a lovely girl!" thought the Prince; and he watched her till she passed out of sight.

Now, the Prince had fallen in love with the Princess at first sight, and he determined to win her. Losing no time, he set out the next day for the Palace. On the outskirts of a wood, through which he had to pass on his way, he noticed what he thought to be a huge beast lying by the wayside. But, on going nearer, he found that it was no beast, but a man—the biggest man he had ever seen. He touched him on the shoulder, and the man stood up, and asked:

"Do you need a servant?"

"If I did," returned the Prince, "I don't know what I should do with such a great fat fellow as you."

"What does my size matter," answered the man, "so long as I discharge my duties faithfully?"

This answer pleased the Prince so much that he engaged the man on the spot. When they had gone along a little farther, the Prince came across a man who lay on the grass with his ear close to the ground.

"What are you doing?" asked the Prince.

"Listening," said the man. "I can hear all that goes on in the world."

"You may be valuable to me some day," said the Prince. "Follow me."

Before they had gone very far they came across a pair of feet, and, a little farther on, a pair of legs; and then they found a body; and then, at last, the head.

"Bless me," exclaimed the Prince "what an extraordinary man!"

"Oh," replied the man, "this is nothing to what I can do when I stretch myself to my full height! When I choose I can make myself three times as tall as the highest mountain."

"Follow me," said the Prince. "Some day you may be of great service."

Then an extraordinary thing happened. The man muttered some words and in an instant he shrank to the size of an ordinary man.

This strange little band journeyed on till they came upon a man who shivered with cold though he sat in the blazing sunshine.

"Are you ill that you shiver in this heat?" inquired the Prince kindly.

"Indeed," answered the man, "something must be wrong with me, for the sun, instead of warming me, sends cold thrills over me; while the cold and ice of winter oppress me so that I often faint as from heat."

"How very extraordinary!" said the Prince. "Still, as you seem to have nothing to do, follow me, and I will take you into my service."

A little farther on they found a man who was standing on tiptoe, eagerly scanning the land.

"For what are you looking?" asked the Prince.

"I am watching the world," replied the man. "My eyes are so sharp that I can see from end to end. If you need a servant, you may find me very useful."

"True," said the Prince. "Follow me."

When they arrived at the Palace, the Prince was shown before the Queen, from whom he begged the hand of the lovely Princess.

"The man who would win her," replied the old Queen, "must earn her."

The Prince was prepared for this, and asked what his task was to be.

"There are three," replied the Queen. "First, bring me the ring that I dropped in the Red Sea."

"That is simple," said the man who could make himself as tall as the highest mountain.

"Why, there it is!" exclaimed the sharp-eyed man, "just by that green rock." Whereupon the tall man stretched himself to his full length, bent over, and picked it up.

The Queen was furious when the Prince handed her the ring, although she pretended to be pleased.

"You have indeed done well," said she; "but you may not find your second task so easy. Yonder are a hundred fat oxen; these you must eat before noon. And in a cellar below are one hundred casks of wine; these you must drink so that not a drop remains."

"May I invite a guest?" asked the Prince.

"Certainly," replied the Queen, with a spiteful laugh. "One, and one only."

The Prince turned and found the fat man at his side.

"Just leave this to me, Master," said the man, well pleased at the prospect. And by noon nothing remained of the feast but a hundred empty wine-casks and a pile of bones.

This time the Queen could scarcely hide her anger.

"Your third task you may find more difficult to perform," she said. "At sunset I shall bring my daughter to your apartments, and leave her in your care. See to it that she is still there when I return at midnight."

"That does not sound impossible," thought the Prince; "with the help of my five servants I think I can manage to keep the Princess."

At dusk the Princess arrived. The Prince led her to a low-cushioned seat by the window, and the Queen went away. As the door closed behind her, the Prince clapped his hands, and immediately his servants made silent preparations for the watch. The tall man stretched himself to his full length, and wound himself round and round the little house, so that none could go in nor pass out; the sharp-eyed man closely watched the movements of the Queen; while the man with the wonderful hearing remained motionless with his ear to the ground.

Within the room all was silence. The moon streamed through the open window on to the face of the lovely Princess, who sat with folded hands gazing idly at the stars; and behind, his face in shadow, stood the Prince watching her, and wondering at her exquisite beauty.

But suddenly, as the clock struck eleven, the old Queen threw a spell over them, so that they all fell asleep; and while they slept the Princess vanished. But, clever as she was, the old Queen had

no powers of enchantment after a quarter to twelve, and as the clock chimed they all awoke, and the Prince started to his feet.

"Alas, alas!" he cried, "my beautiful lady is gone! All is lost, lost!"

"Not so," cried the man with the wonderful ears. "I hear her weeping, but the sound comes from afar."

"I see her seated on an enchanted rock three hundred miles away," cried the sharp-eyed man.

"Describe the place," said the tall man, "and I will bring her here in three minutes."

When the old Queen came back at twelve o'clock, she was amazed to find her daughter sitting just where she had left her.

"Take her; you have won your bride," she said to the Prince. But as she passed she whispered to the Princess:

"I would scorn to be won by a pack of servants."

The idea was so displeasing to the pride of the Princess that she turned to the Prince, and said:

"Before you can win *my* consent, one of your wonderful servants must consent to be flung on a pile of three hundred burning logs of wood, and there remain till the fire has quite burned out."

"You hear," said the Prince to his servants. "Will any of you consent?"

"I will," answered the frosty man, stepping forward without any hesitation.

So the logs were brought, and the fire started; and for three whole days the Court watched the man as he lay shivering and shaking with cold on the burning pile. When the last flame had flickered out, and the glowing embers had turned grey, the frosty man rose to his feet and said that he had never felt so cold in his life.

The Princess was delighted that her handsome lover had once more triumphed. She held out her hand, and the Prince bent down and kissed it.

Now that the old Queen no longer had any excuse for delay, the bridal day was fixed, and the wedding took place amid scenes of great enthusiasm, for the Princess was much loved by her people, and the Prince had shown himself to be as clever as he was handsome.

After the ceremony, the Princess arrayed herself in her finest dress and her most costly jewels, and together she and the Prince set out for the Palace. Here they were received with great kindness by the old King and Queen, and they lived very happily together all the rest of their lives.

HOW THE BAD NEWS REACHED THE KING

THERE is a good story told of that strange personage, Frederick the Great of Prussia. He had a good knowledge of French and a taste for literature and music. He was very loyal to his mother and much attached to his sister, Wilhelmina, and usually very kind-hearted. Sometimes, however, his temper got the best of him and he was hasty in his words.

To one creature he was most passionately devoted, and this was a horse. It was a handsome charger, fit for a king to ride upon, and so intelligent and affectionate that it quite softened and won the heart of its royal master.

One day, when he was very much put out and busy, he learned that this favorite was ill. In a fit of petulant rage, feeling his own insignificance at not being able to keep even a horse alive, even though he was a great monarch, he called out that any man who should inform him that the horse was dead should be instantly hanged.

A few days passed without any change in the charger's condition, but one morning the equerries, in going their round of the stables, were met by the groom, who told them that the King's favorite horse was dead.

Just imagine their consternation. Who was to tell the King? Who was to run the risk of being hanged? They stood talking and proposing various plans until the hour arrived for the daily bulletin to be delivered to his Majesty. At that moment one of the youngest equerries told the groom not to be afraid, and went himself to the King.

"Well!" demanded Frederick; "how is the horse?"

"Sire," replied the equerry, "the horse is in his usual place. He is lying down. He does not move. He has no strength. He does not eat. He does not drink. He does not sleep. He does not breathe. He does not——"

"Then, indeed," cried the King impatiently, "he must be dead."

"Your Majesty has spoken truly," replied the equerry calmly; "and it is you, sire, who have announced the fact."

THE FABLES OF ÆSOP THE SLAVE

THE CAT AND THE MICE

A CERTAIN house was overrun with mice, so its owners got a cat, who caught and ate a great number of the mischievous little animals.

The mice, finding their numbers growing thinner, consulted together how best to preserve themselves from the jaws of the cat, and they decided that none of them should go down below the top shelf, where the cat could not get at them.

The cat, finding that the mice no longer came down, got very hungry, and resolved upon a clever trick. She hung by her hind legs on a nail on the wall, and pretended to be dead, hoping by this means to persuade the mice to come down.

She had not been hanging there long before a cunning old mouse peeped over the edge of the shelf, and said: "Ah, my good friend, you may hang there as

long as you like; but I certainly would not trust myself with you even if I knew that your skin was stuffed with straw."

It is better to be on the safe side.

THE TRAVELERS AND THE BEAR

TWO men, traveling through a forest together, promised to stand by each other in case any danger should threaten them. They had not gone very far when a bear came rushing out of the wood.

Thereupon one of the travelers, being a good climber, got up into a tree. The other, who could not climb, fell flat upon his face and lay quite still, holding his breath. The bear came up and smelled him, but, supposing him to be dead, went back into the wood without doing him any harm.

When the danger was over, the man who had climbed the tree came down to his companion, and asked him what it was the bear said when he put his mouth so close to the man's ear.

"Why," answered the other, "he advized me to take care in future not to put

any trust in such a coward as you are, or I should always be deceived."

A true friend will always stand by his companion in danger.

THE FIR-TREE AND THE BRAMBLE

A TALL, straight fir-tree that stood towering up in the forest was very proud of his height and dignity, and despised the little shrubs which grew beneath him. One day a bramble asked him why he was so proud.

"Because," replied the fir-tree, "I look upon myself as the finest tree for beauty of any in the forest. My top shoots up towards the clouds, and my branches spread round in constant beauty, while you crawl on the ground, liable to be crushed by every animal that comes near."

"All this may be true enough," replied the bramble; "but when the woodman has marked you for cutting

down, and the axe comes to be applied to your root, I fancy you will wish that you could change places with me."

Pride always goes before a fall.

FOOLS AND JESTERS AND KINGS

ALMOST as old as history is the Court fool, or jester, of whom we read in so many of Shakespeare's plays. The reason for these droll creatures is not generally known. They were employed to aid digestion.

When we laugh, we exercise certain muscles which play an important part in the digestion of food. The more we exercise these muscles the better can we digest our dinners. People in ancient times, who ate enormously, soon discovered that a dinner at which they sat glum and silent, or at which they only talked about serious things, gave them a good deal of bother to digest. And so funny fellows were procured, who by their antics sent the eaters into shouts of laughter.

But, as the world moved on, the absurd follies of fools ceased to make men laugh, and instead of the fool came the jester. There was all the difference in the world between the Court fool and the Court jester. The fool was a mere knockabout clown; the jester was a polished and brilliant wit, an inimitable teller of good stories, a critic of politics, religion, and manners. The jester looked down upon the clown, and despised him for an ignorant person of low degree. The jester became an influential courtier, one of the most powerful men at the King's elbow.

He could avert war, save a noble from execution, get justice for the poor, and improve manners. So long as he kept the King amused, or served his Majesty with the sauce of laughter at dinner, the jester was one of the very first men in the kingdom. The first Court fool known in history was a woman. This was Iamby, who was famous at the Court of the Queen of Eleusis for her frolicsome humor, her funny stories, her playful gambols, and her merry tales.

THE FABLES OF ÆSOP IN FRENCH

THE ENGLISH VERSION OF THESE FABLES IS GIVEN ON PAGE 891.

LE LOUP ET LA CIGOGNE

UN loup, mangeant son dîner, un jour, avala un os qui s'arrêta dans sa gorge. Il errait en hurlant, demandait à tous les animaux qu'il rencontrait de l'aider et promettait une forte récompense à qui retirerait l'os. Enfin, une cigogne, avec un cou et un bec longs et minces, entreprit la chose.

Elle introduisit son long bec dans la gorge du loup, saisit l'os et le retira; mais quand elle demanda sa récompense, le loup répondit en riant: "Estimez-vous heureuse que je n'ai pas mordu votre tête quand elle était dans ma gueule."

Il y a des gens sans reconnaissance pour les services rendus.

LA GRENOUILLE ORGUEILLEUSE

UN bœuf qui paissait dans un champ, mit par hasard son pied au milieu d'une famille de jeunes grenouilles et en écrasa une. Les autres racontèrent à leur mère ce qui était arrivé et dirent que l'animal en question était le plus gros qu'ils eussent jamais vu.

"Était-il aussi gros que ceci?" demanda la vieile grenouille en se gonflant, de la façon particulière aux grenouilles.

"Oh, bien plus!" dirent les petites grenouilles.

"Aussi gros que ceci ?" demanda-t-elle, en redoublant ses efforts.

"Oui, mère," dirent-elles, "vous ne seriez jamais aussi grosse, même en vous gonflant à en crever."

La vieille et sotte grenouille fit encore un effort pour se gonfler davantage, et elle éclata et mourut.

N'essayez jamais de vous faire prendre pour une personne plus importante que vous n'êtes en réalité.

LE GEAI VANITEUX

UN geai était si vaniteux que ses simples plumes noires ne le satisfaisaient pas. Il ramassa un grand nombre de belles plumes tombées de la queue d'un paon et les attacha avec soin sur son dos.

Puis il essaya de se mêler à la famille des paons comme s'il en faisait partie, mais sa ruse fut bientôt découverte et les paons le frappèrent tant à coups de bec, qu'il fut heureux de s'échapper.

Il retourna chez ses anciens amis, les geais; mais ils le chassèrent et ne voulurent plus être ses amis.

Nous serons découverts, si nous prétendons être plus que ce que nous sommes.

THE NEXT STORIES ARE ON PAGE 4409.

THE COMMON MALLOW

This plant is called rags-and-tatters, but that is not a fair name, for the pale purple flowers are very showy, and, except where they have been riddled by snails and caterpillars, the leaves are quite attractive.

THE CORNFLOWER

This is the German national flower. A lotion used to be made from the flowers to strengthen the eyes, and the French call them break-spectacles, meaning that, after using the lotion, glasses are no longer needed.

THE CHRISTMAS ROSE

This is one of the garden flowers rarely seen on this side of the ocean, and is not a rose. Its root is called black hellebore, and although acridly poisonous, has been used as a medicine. It blooms very early in the spring, and even in freezing weather.

THE VIPER'S BUGLOSS

This handsome plant, with its red and blue flowers, was supposed to give protection against a viper's bite. The name means an ox's tongue, and refers to the shape of the leaves. The flowers are very rich in honey, and are much visited by bees and other insects.

PLANTS OF TWO WORLDS

CONTINUED FROM 4213

THERE are a number of flowers which we now value highly, that have been introduced into North America in much the same way as those we have called weeds. On the other hand there are others that grow naturally in both the Old and the New Worlds.

THE GOLDEN STARS OF THE WALL-PEPPER

In the first group, we find the wall-pepper, which spreads its stem, crowded thick with scale-like succulent leaves, in great mats, over stones and dusty waysides. Probably we are well acquainted with it as a rockery flower in gardens; here it is quite wild and very abundant, its wide-spreading, fine petals looking like golden stars on green cushions. All the stonecrop family have thick leaves, in which they store up moisture to enable them to grow in the hot, dry, stony places where they are mostly found.

THE DELICATE WOOD-SORREL OF THE NORTH

The delicate wood-sorrel grows in cold woods throughout the northern hemisphere. Its knotted, slender, crimson stems run through the leaf-mold, and put out their large trefoils, that look like pale clover-leaves. Above them rise the thin stalks that support a single flower of purest white, streaked with the finest line of purple to show where the nectar is to be found at the base of the petals. There are ten stamens, and the single pistil has five stigmas. The seed-vessel has five ridges, which split when the seeds are ripe, and they are shot out to a distance of a yard or more. Before the seeds are ripe, the plant keeps the seed-vessel hidden under its leaves; but afterward the stalk stands upright to raise the seed-vessel well above the leaves, so that when the seeds are fired out, so to speak, they may land far away. The wood-sorrel, like some violets, has two kinds of flowers,—one kind is that which we have just described, and the other has little greenish, bud-like affairs borne on recurved stalks at the base of the plant. Although these flowers have no means of attracting insects they are able to develop seeds that will grow as they pollinate themselves. If insects visit the gay flowers above, well and good, but if not the cleistogamous (as they are called) inconspicuous flowers will ripen fruit. The three heart-shaped leaflets drop in the sunshine. Some people think that sorrel is the real "shamrock" which was mentioned by St. Patrick.

Copyright, 1911, 1918, by M. Perry Mills.

THE FOOL'S PARSLEY

This plant is poisonous. Because people have often gathered it under the impression that it was parsley, and have died through eating it, [it has gained the name of fool's parsley. It has an evil smell.

THE COMMON BUGLE

The common bugle does not look attractive in the woods or by the roadside, where it creeps along, sending up high flowering stems, with flowers that are usually deep blue but sometimes white.

THE WOODY NIGHTSHADE

The woody nightshade, or bittersweet, a familiar object in our woods, belongs to the potato family. The flowers are purple and yellow, and the leaves vary in shape. The berries are a brilliant scarlet when fully ripened. It grows in thickets, and is dangerous to eat.

THE HARE'S-FOOT TREFOIL

This flower, which is one of the clovers, gets its popular name from a supposed resemblance of its soft, hairy blossoms to a hare's foot. It grows in dry fields, and its numerous flowers are pinky white in color and delicate. The plant grows about a foot high.

THE BITING STONECROP

When this plant is in blossom, its bright golden stars present a very attractive sight. Its leaves have a sharp, biting taste, which has given the plant its name.

THE BIRD'S-FOOT TREFOIL

This is one of the pea family, and the bright little flowers are succeeded by pods which spread out and suggest a bird's foot. The plant is used for fodder.

THE GERMANDER SPEEDWELL

This has various names, birdseye, and catseye, and it is often called forget-me-not, although the real forget-me-not is another flower—the myosotis. The germander speedwell used to be considered unlucky.

THE TUFTED VETCH

This is one of the most ornamental of wild flowers. Its purple flowers add a delightful touch of color wherever it grows. When the flower withers, the seed-vessel grows into a pea-pod with a curly tail.

THE HERB-ROBERT IS A SMALL GERANIUM

In the large, wide-spread geranium family we find the soft, hairy herb-robert, in our country often perched on damp rocks and banks. It has much-divided leaves, more or less reddened (and sometimes entirely red), which have an unpleasant smell when passed through the hands. This has led to its being called in some parts of England by the equally unpleasant name of "stinking Bob." It has pale, magenta flowers with fine lines, or "honey-guides," of red on its petals. Its stems are red, also, and its joints where the leaves are attached, are swollen. It flowers all summer. The seed-vessels have a long column or beak with a circle of five one-seeded pockets at its base. By a process of unequal drying when the seeds are ripe, the coverings of these cavities, which are prolonged into long tails reaching to the apex of the beak, are suddenly jerked up and curled in rolls at the tip of the fruit, and the seeds therein are sent flying away. It is done so quickly, when one touches a thoroughly ripe capsule, that it makes a person jump. And this is the habit of all the geraniums.

Plants which are found along railroad tracks and about seaports, the seeds of which have slipped out of grain-bearing freight cars, or during the process of unloading grain from ships; or have, perhaps, been brought in the ballast of the ships, are often called ballast plants. They are generally inoffensive, and are regarded as fugitives, as it were, from foreign countries. Occasionally, however, they become weeds.

THE VIPER'S BUGLOSS, SOMETIMES CALLED THE BLUE-WEED

There is a stretch of railroad track along the Hudson River that is gay with the viper's bugloss, a bristly ballast plant with oblong and lance-shaped leaves and a straight stem three feet high. From the upper part of this stem, short, curved side-branches are given off, which bear crowded flower-sprays. These flowers, before they fully open, are often purplish red in color, but when they expand they turn to a most brilliant red. In Canada and elsewhere it is called blue-weed, and is a troublesome plant in rocky pastures. The quartette of little nutlets that each plant contains are scattered broadcast as the dead plants are blown over the country. The scarlet stamens, and the style, jutting well out from the flower, form a platform for insects, by means of which they both deposit and take away pollen carried on the under surface of their bodies. The blue-weed, in spite of its coarseness, is a very close relative of the delicate forget-me-not and heliotrope, all alike belonging to the borage family.

THE YELLOW-FLOWERED BIRD'S-FOOT TREFOIL

The bird's-foot trefoil with pale yellow flowers that is common in every field of England, here appears only as a ballast plant. It belongs to the pea family and has some odd habits. It is one of the plants that sleep at night, each one of the triple leaflets hanging straight down from the tip of the leaf-stalk after sundown. The wings are folded over the keel, so as to form a kind of cushion for a honey-seeking insect, and as it settles down astride their saddle a little, worm-like thread of paste appears at the tip of the keel and sticks to the bee's under-surface. This is pollen. The club-shaped anthers form a sort of partition between the main cavity of the keel and a small one at its very tip. This latter space is filled with pollen by the anthers, the longest style projecting into the mass. Pressure on top of the keel forces the stamens and the style upward and forward so that they push the pollen out through a small hole at the tip, exactly as the plunger of a pump forces water out of its spout. If the keel be pressed, the style itself is pushed out, and is likely to take up some pollen from the visitor's coat.

THE FLOWER OF THE STONE-CLOVER LOOKS LIKE A SOFT BRUSH

In the pea-flowered family we also find the old-field or stone-clover, whose fluffy heads of flowers are supposed to resemble the foot of a tiny hare, whence its common American name of rabbit's-foot clover. It does not look much like a clover at first sight, for its trefoil leaves have very slender leaflets and its calyx teeth are so much longer than the petals that they give the flower-head the appearance of a soft brush, amid which the tiny pink petals are almost hidden. It has become very thoroughly naturalized, but is useless for fodder, and, therefore, is left in sole possession of disdained, dry, stony fields.

THE TUFTED VETCH, ALSO CALLED THE COW-VETCH

The tufted vetch, another pea, is just as much a native of America as it is of Europe or Asia. Its weak stems thrust out dense, one-sided sprays of bright blue drooping flowers, that, like those of the hare's-foot clover, are fertilized by means of the pressure exerted on the keel. It is a persistent perennial, difficult to get out of old meadows, but as its foliage with many leaflets affords a good fodder (whence, perhaps, its name of cow-vetch), this does not so much matter.

FOOL'S PARSLEY, AN UNDESIRABLE IMMIGRANT FROM EUROPE

In the carrot family, which contains many poisonous plants, very easily mistaken for harmless ones, we have the fool's parsley, which, although originally brought from Europe, has become sufficiently at home in waste places to be guarded against. It is a slender-stemmed herb, with delicate, shiny, much-divided leaves, known as fool's parsley because no wise person would be likely to mistake its uncurled leaves for those of the true parsley. It grows to about two feet in height and bears umbels of tiny white flowers. From the base of each umbel hang down from three to five slender green points, or bracteoles. This should be remembered as an especial point by which to recognize this poisonous plant. Its seeds, that are not to be tasted, are in pairs forming nearly spherical strongly-ribbed, shining fruits.

THE POISONOUS WOODY NIGHTSHADE, OR BITTER-SWEET

Another one of the poisonous plants that we find depicted here, is the woody nightshade, or bitter-sweet, a member of the potato family, which has made itself thoroughly at home in our thickets, and climbs in a half-hearted manner over shrubs, or merely straggles along the ground. It has rather unusual leaves, ovate or hastate in general outline, but three-lobed or divided, the apical lobe being the largest. It has a typical potato blossom, in cymes, star-like, with yellow stamens projecting like a beak, but usually the flower is dull purple. The berries succeeding the summer blossoms are among our most striking fruits, as they are fleshy and egg-shaped and when fully ripe are a brilliant scarlet; but in one cluster we may find green or yellow, as well as red berries. It is a dangerous plant to eat.

THE LEAVES OF THE SETTERWORT ARE GREEN ALL WINTER

In Great Britain they have also the early flowering, stinking hellebore, or setterwort, that is also a hellebore, both of them belonging to the buttercup family. As in some other members of this family, the showiness of the flowers is due to the large sepals. The setterwort's leaves are large and handsome, and are divided into a number of leathery, slender leaflets, which spread out from the top of the leaf-stalk like the outstretched fingers of our hands. They are dark green, and retain their color and freshness throughout the winter; but in the new year the stem makes a sudden growth and puts forth oval, leafy bracts and large, drooping flowers. We should scarcely find the true petals unless we knew where to look for them, for they have been turned into little green two-lipped tubes that are filled with nectar, and these are hidden at the bottom of the flower beneath the many stamens that stand crowded around the two or three pistils. The flower opens slightly, when the curved stigmas overtop the unripe stamens and receive pollen brought by any early bees or flies, which have to crawl over them and into the flower to reach the nectar. Later the stamens spread out more, the outer sepals get a line of purple along their edges, and the anthers shed their pollen. When this is all gone the stamens drop off, and the pistils grow into seed-pouches that open at the top, something like those of the columbine.

THE SWEET MARJORAM HAS TWO KINDS OF FLOWERS

Another garden plant which we know well is the sweet marjoram, a mint that in its native land covers wide stretches of downland. Its perennial underground rootstock sends out runners all round, so that we always find it in masses. The branching, square stems grow to about three feet in height, and are clothed with oval leaves that end in clusters of purple flowers. These are of two sizes, the larger dark purple ones having both stamens and pistil, while the smaller and paler ones have only a pistil. The yellow-dotted calyx is almost hidden by the larger purple bracts. Beginning to flower in July, they keep

THE HERB-ROBERT

The dainty little herb-robert, with its delicate pink flowers and its crimson leaves, is a wild geranium. In some parts children call it by the name kiss-me-quick.

THE STINGING-NETTLE

We all avoid the stinging-nettle although if the leaf be grasped quickly and firmly it gives no pain. The flowers are smaller than those of the dead-nettles.

THE RED DEAD-NETTLE

This flower is no relation of the stinging-nettle, although the leaves of both are very much alike. The name dead-nettle was given because its foliage has no stinging power. This flower is also called archangel.

THE WHITE DEAD-NETTLE

This flower is very much like the red dead-nettle, but is larger in all its parts. It is stingless, and blossoms from spring to autumn. The dead-nettle is not eaten by animals when it is with the stinging-nettle.

THE SWEET MARJORAM

This is one of our kitchen herbs, and an oil from it is used to relieve toothache. The plant is fragrant, and the light purple flowers growing in thick clusters at the ends of the stalks add charm to its native downs.

THE GUELDER ROSE

This belongs to the honeysuckle family, to which the elder-tree also belongs; in fact, another name for the guelder rose is water-elder. It is also called the May rose and the tisty-tosty. The flowers are snow-white.

THE GROUND-IVY

The ground-ivy, which is one of our earliest spring flowers, is no relation to the real ivy. It used to be called ale-hoof, and was much used in brewing. It is also called Gill-run-over-the-ground.

THE WOOD SORREL

The charming wood sorrel, with its white pink-streaked flowers, is often called the hallelujah, because it blossoms at Easter. The wood sorrel is thought by some to be the original shamrock of St. Patrick.

up a continuous display well into the autumn.

THE BRIGHT BLUE CORNFLOWER OR BACHELOR'S BUTTON

Another common garden flower is that composite of many names, such as bachelor's button, bluebottle and cornflower, but we here must always remember that corn to the Englishman does not mean maize, or Indian corn, but grain, especially wheat. The round base of the flower-head, covered or protected by broad scales, somewhat suggests a thistle, but it has very conspicuous rays. The inner flowers are purple and tubular, but the outer florets are like trumpets with jagged brims. The flowerets in the cornflower have divided their duties. The brilliant azure of the large flaring flowers on the outer circle of the flowering heads serves only to attract insects, for they are without pistil or anthers. The fruitful ones are the insignificant purplish ones within the centre. These have both pistil and stamens, the latter united into a ring about the flower, poised on slender filaments. They exude pollen until the tube of the flower is quite filled, for the attraction of insects.

THE STINGING-NETTLE HAS COME FROM THE OLD WORLD

Many a child, whose bare limbs are scarlet and prickling, rues the day when the stinging-nettle first extended its travels from the Old World to the New. It does not in the least interest that child, at that moment, to know that hemp-fibres, woven into the ropes he plays with, have been extracted from a plant of the same family. The stings are inflicted by the peculiar weapons borne by the nettle for warding off plant-eating animals. Each hair is expanded at the base and at the top is swollen into a little round cap bent to one side. At this bent portion the walls are very thin, and the head is broken off at the slightest touch, leaving a sharp point that penetrates the skin, and by means of which the irritating contents of the hair are forced into the wound. Oddly enough an acid possessed by ants, and which helps to make a bite of that insect burn, is present in these nettle-hairs. These hairs irritate the membranes of the mouth and nose of browsing beasts, and they carefully avoid the plant.

Among the nettles may grow the dead-nettles that are members of the mint family and therefore are not nettles at all, but have been so called because the leaves of the white ones are very much like those of the stinging-nettle. As these do not sting they are called dead-nettles, or in some places dumb-nettles.

THE WHITE DEAD-NETTLE HAS NO STING

Most frequently we shall find the white dead-nettle growing against, or among, a clump of stinging-nettles, and then we shall notice how much the leaves of the two plants are alike. The dumb animals, dreading lest they be stung by the real nettles, and evidently observant of the general appearance of a nettle-plant, carefully avoid all other plants of like appearance. Consequently the dead-nettle is left uneaten and is able to ripen its seeds in safety, especially when in company with the stinging-nettles. This is a form of self-defence obtained by a likeness to a dangerous plant—protective mimicry it is called.

GROUND-IVY, OR GILL-RUN-OVER-THE-GROUND

The ground-ivy, another scentless mint, has earned for itself the name of Gill-run-over-the-ground; a kind of name that reminds one of Creeping Jenny or Wandering Jew. These names have been earned by the plant's habit of traveling over the ground by means of long runners. We often see the ground-ivy along damp banks, or in shady thickets, as it creeps under the hedgerows of England whence it came, forming carpets of furry, nearly-round and evenly-toothed foliage, and holding up little clusters of blue-purple flowers very early in spring. It also has smaller flowers containing only a pistil.

THE PRETTY BLUE FLOWER-SPRAYS OF THE GERMANDER SPEEDWELL

Upon sunny banks in early summer we are sure to find the germander speedwell, or bird's-eye. The bright blue blossoms in the axils of the upper sessile leaves, have a short tube to the corolla. Of the four lobes that represent the petals, only two are of the same size. All are marked with fine lines of darker blue, leading to the mouth of the tube, and to guide the flies that carry the pollen, each is margined with white. The stamens bend downwards and inwards, to insure pollination.

THE NEXT NATURE STORY IS ON PAGE 4473.

THE PEASANT AT THE FLOOD

CONTINUED FROM 4192

MORE than a century ago terrible floods were experienced in the neighborhood of Verona, owing to heavy falls of snow in the Italian Alps, followed by a rapid thaw. To-day, the farmers have learned by skilful engineering to make use of the surplus water for their crops. Then, the rivers came dashing and roaring down from the mountain-sides, overflowing their banks and carrying everything before them. Among other disasters a bridge over the River Adige was carried away, all except the middle part, on which was built the house of the toll-gatherer, and he and his family were thus left on a kind of timber island that might at any moment be swept away by the raging torrent.

The man with his wife and children appeared at the windows of their house, waving their arms frantically for help, and screaming to the on-lookers in the distance to rescue them from their peril. But although there were many on the banks anxious to help the stranded family, none dared to venture upon the surging waters.

The Count of Pulverini, a nobleman of the district, came upon the scene and offered a reward of fifty pounds to anyone who would try to rescue the family, but no one would undertake the dangerous task.

At this moment a peasant, traveling from another part of the country, came to the spot, and immediately jumped into a boat, and began to pull out towards the bridge-house. But the current was swift, and only by almost superhuman effort was he ultimately able to bring the boat alongside the broken piers of the bridge on which the house stood.

"Courage, my friends!" he shouted to the endangered family, and inspired by his confidence they climbed down into the boat.

Then came the return journey, which was even more dangerous than when the peasant first set out, for now he had a boat-load of passengers; but his strength was great, and his courage and determination were greater still, and at last he landed all safely on the banks.

The crowd broke out into a loud cheer, and the count came forward, holding out his purse by way of recompense; but the peasant, whose name has not come down to us, declined the reward, saying:

"I should certainly not expose my life for money. I can work for all I need to meet the wants of my wife and children. Give the money to those poor people who have lost all."

And so the brave man not only rescued the family, but by his generosity was able to supply them with sufficient money to buy a new home.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Marjorie avait un poney qui s'appelait Jean, à qui elle donnait à manger.
Marjorie had a pony which itself called Jack, to which she gave to eat.
Marjorie had a pony called Jack, whom she used to feed.

Un jour que Marjorie courut à l'écurie elle trouva la porte grande ouverte.
One day that Marjorie ran to the stable she found the door wide open.
One day when Marjorie ran to the stable she found the door wide open.

Elle regarda dans l'écurie, mais Jean n'y était plus. Où était-il parti?
She looked into the stable, but Jack not there was more. Where was he departed?
She looked into the stable, but Jack was not there. Where had he gone?

Marjorie courut dehors dans tout le sentier pour le chercher.
Marjorie ran outside into all the lane for him to look for.
Marjorie ran out and searched the lane for him.

Jean était là, et il y avait un pauvre petit garçon assis sur son dos.
Jack was there, and it there had a poor little boy seated upon his back.
There stood Jack, and sitting on his back was a poor little boy.

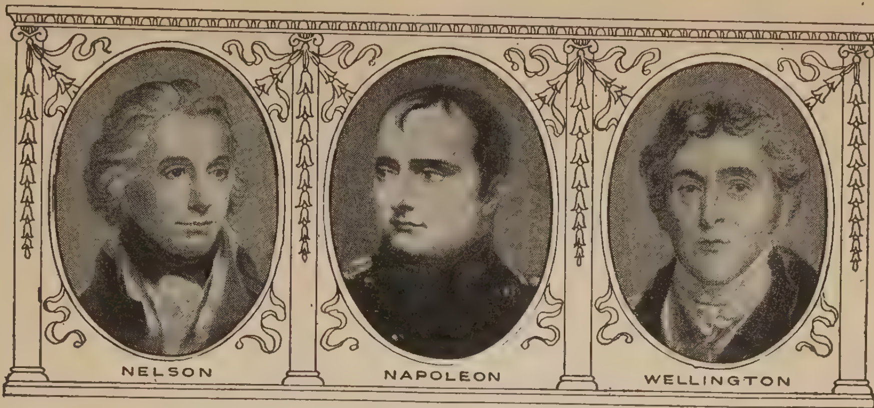
"Mauvais garçon d'avoir volé mon poney," dit-elle. "Autrefois il était à moi.
"Bad boy of to have stolen my pony," said she. Formerly he was to me.
"You bad boy to steal my pony," said she. "He was mine once.

Quand nous sommes devenus pauvres mon père vous l'a vendu," dit le garçon.
When we are become poor my father to you him has sold," said the boy.
When we became poor my father sold him to you," said the boy.

"Et j'étais si heureux de le revoir que j'ai sauté sur son dos,"
"And I was so happy of him to see again that I have jumped upon his back."
"And I was so happy to see him again that I just jumped upon his back."

"Pauvre garçon," répondit Marjorie, "je vous le prêterai quelquefois."
"Poor boy," replied Marjorie, "I to you him will lend sometimes."
"Poor boy," replied Marjorie, "I will lend him to you sometimes."

"Merci bien!" Le petit garçon courut chez lui heureux comme un roi.
"Thanks well!" The little boy ran to the house of him happy as a king.
"Oh, thank you!" And the little boy ran home as happy as a king.


NELSON NAPOLEON WELLINGTON

NELSON, WELLINGTON, NAPOLEON

THREE MEN WHO CHANGED THE WORLD

CONTINUED FROM 4258

ABOUT a century and a half ago, a baby was born at Ajaccio, on the island of Corsica, in the Mediterranean Sea, who was destined, as the saying goes, to turn the world upside down. His family name was Buonaparte, an Italian name, though when he became famous he changed the spelling to the French form Bonaparte. His Christian name was Napoleon.

It is interesting to remember that Napoleon, one of the most famous of French rulers, would not have been a French citizen by birth if he had been born even a year earlier. Corsica had for a long time belonged to the Republic of Genoa. But the Corsicans were much dissatisfied with the treatment which they received from Genoa. They constantly broke out in rebellion against the Genoese, and at one time the revolutionists asked the Government of England to go to their aid. England, however, refused to take them under her protection. In 1768, Genoa, realizing that she could not control the island, sold all her rights over it to France. Since that time, Corsica has been a French possession, and the Corsicans are so proud that the great emperor belonged to them that they have become patriotic Frenchmen.

When he was old enough, Bonaparte was sent to school at Brienne in France. The young Corsican, with his Italian blood, did not get on very well with the French boys, who little thought he would afterwards became a national hero to the French. But he succeeded with his studies, and was particularly fond of two subjects—mathematics, which are very necessary to make anyone a master of one part of the art of war; and the history of the great conquerors, and how they were victorious in their wars, so that he learned the secret of their successes. He spent four years at Brienne, and from there went to the military school at Paris.

It was just about the time when the French Revolution was beginning that the little, thin, olive-skinned Corsican became a lieutenant in the artillery. When the French had cut off their king's head, and declared war against all the crowned monarchs of Europe, the Royalists, who would not obey the Republicans and Robespierre, got possession of the harbor of Toulon, and Spanish and British ships went to help them.

The Republicans sent an army to

besiege Toulon, and a clever plan of the youthful Bonaparte, who had already been made a captain of artillery, enabled them to capture it, and then it was no longer possible for British and Spanish ships to stay in the harbor. But young Bonaparte soon got into trouble, in spite of what he had done, because he had made friends with Robespierre's brother; and when Robespierre was overthrown, the people who had been his friends were held in suspicion by the new Government.

Although Bonaparte was only twenty-five, he had found out by this time that he understood more about managing armies than most other people; yet he thought there was so little chance of his rising to hold a high command in the French army that he wanted to go away to Turkey and help the Sultan to make a great army there. However, he got his chance after all, for the Directors, as we read on page 2286, were afraid of losing their power; and one of them, named Barras, thought that if he had that clever young artillery officer on his side, they would soon be able to overcome all resistance that might be offered to them.

That is how Bonaparte got command of the troops, and crushed the revolt against the Directory in Paris. He did it so cleverly that the great War Minister, Carnot, saw that he was fit to hold the very highest commands, young as he was. The Directory wanted a general whom they could use to prevent anyone else from upsetting them, but they did not imagine that their own general would become their master. So, as the French wanted to drive the Austrians out of their possessions in the north of Italy, and Bonaparte had made a very skilful plan for doing it, he was sent off to command the army in Italy.

BONAPARTE AT THE MILITARY SCHOOL AT BRIENNE, TO WHICH HE WENT AT TEN YEARS OLD

Before he went he had just time to marry Joséphine de Beauharnais, a lady with whom he had fallen violently in love. A week later he was well on his way to the war, and then he began to win victory after victory in a way which astonished everyone. For when Bonaparte was in command, the soldiers soon learned that they could do things which everyone else supposed to be impossible. It is easy for a man to walk twenty miles in a day. But it is very difficult to march several thousand men with all

NELSON ABOUT TO JOIN HIS FIRST SHIP

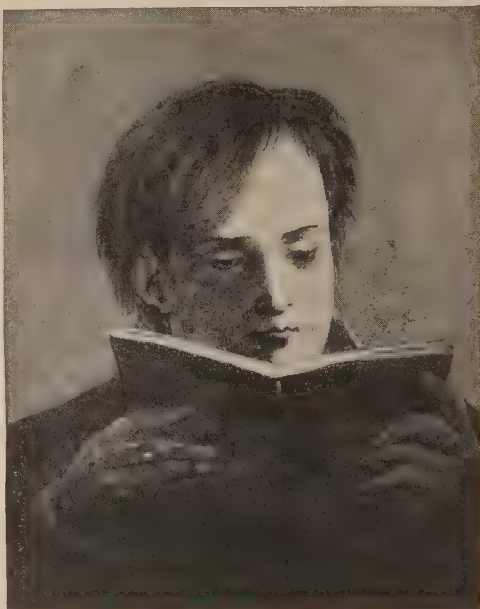
When Nelson was only twelve years old, his father wrote to an uncle, who commanded a war vessel to ask if the boy might join the ship. "What," replied the uncle, "has poor Horatio done, who is so weak, that he, above all the rest, should be sent to rough it out at sea? But let him come, and the first time, we go into action a cannon-ball may knock off his head, and provide for him at once." It was not a promising introduction to naval life, but Nelson grasped the opportunity of becoming a sailor, and here the artist, Mr. George W. Joy, shows us the boy bidding good-bye to his grandmother before setting off for his first ship.

their stores, supplies and artillery over that distance, and to do it day after day. This is what Napoleon did.

Bonaparte was so skilful in moving great masses of men swiftly over a great deal of ground that he appeared again and again before the enemy, ready to attack them before they could occupy strong positions; and so, though the Austrian armies were much larger than his, he was able to hurl his whole force against one part of the enemy, and beat them utterly before the rest could come to their help.

Besides that, soldiers are usually ready to follow anywhere a leader who is perfectly fearless himself, and so, in a few months, Bonaparte had driven the Austrians out of Italy. He crossed the Alps which divide Italy from Austria, and was marching upon Vienna, the Austrian capital, when the Austrians offered to make terms with the victor.

Bonaparte had not been inclined to do whatever the Directory in Paris told him; now they began to be nervous about what he might do next. So they were very well pleased when he proposed to conduct an army to Egypt and take possession of it in order to strike at the British in India. They thought it would be just as well to keep such a popular and brilliant and self-willed soldier out of the way. But Bonaparte meant to conquer Egypt and Western Asia, and then with a mighty army at his back, to turn and make himself master of all Europe.



NAPOLEON WHEN A BOY

From a sketch by M. Girodet, by permission of Messrs. McClure.

Now let us look at the man who was able to spoil that plan of Bonaparte's, and who, before he died, made England safe against all the great Corsican's schemes. For we must know that Bonaparte saw there was no power in the world which stood in the way of his ambitions so much as the British, and he was bent, above everything, on ruining that power.

Nearly eleven years before the birth of Bonaparte, Horatio Nelson was born in a country vicarage called Burnham Thorpe. He was a delicate little boy, but just as plucky and fearless as could be, and he was quite determined to go to sea; so he was allowed to do so, though everybody thought the life would be so hard that it would be sure to kill him. But he was not the kind of boy to get killed in that way.

On one of his first voyages he went to the Arctic regions, and what must he do but go out with another midshipman to try and kill a Polar bear. It was lucky that some more of his shipmates came along, for young Nelson had found his bear, and they saw the bear, which he had wounded but not killed, making for Nelson, and Nelson making for the bear with the muzzle of his musket instead of running away. Happily a good shot from one of their guns finished the bear, or there might have been no battle of the Nile and no Trafalgar. But the story shows the boy's mettle. Now, when France and Great Britain were at war, the thing that mattered most to the latter, as it was an island, was that its navy should be stronger than any other, so that it could send its ships wherever it chose and keep its enemies from crossing the seas. The first famous thing that Nelson did was achieved just about the time that Bonaparte was so successful in Italy. The Spaniards had allied themselves with the French, and their fleet and the French fleet together were larger than the British fleet.

When Admiral Jervis saw an opportunity of attacking and destroying part of a large Spanish fleet before the ships which were separated from the main

NELSON IN TRIUMPH AND IN DEATH

Few naval victories have been so complete as Nelson's triumph over the French at the battle of the Nile. With fewer vessels than the enemy, he crept down the French line and destroyed almost their whole fleet. When he returned, he landed at Yarmouth, as shown in this picture by Frederick Roe, and was received with wild enthusiasm. Bonfires were lighted, and his journey to London was a great triumphal progress.

Great as was the victory of the Nile, the supreme triumph in England's naval history was the battle of Trafalgar, which gave to Britain, for more than a century, the mastery of the seas. But the joy of the nation was turned to mourning in the hour of victory by the death of its hero. Here we see the last moments of Nelson in the cockpit of his flagship, the Victory, after he heard of the defeat of the French and Spanish fleets.

body could come to its help, he seized the opportunity and won the great battle of St. Vincent. Yet he might not have won so great a victory if Commodore Nelson had not seen that if he attacked the rest of the Spanish fleet, he could prevent it from coming up to help the other ships, or escaping from the British altogether. And although Admiral Jervis had given different orders, he was very much pleased with Nelson for acting as he did; so, very soon after, Nelson was raised to be a rear-admiral.

Now, not long afterward, Bonaparte wanted to sail to Egypt with his great army, and Nelson was lying in wait to prevent him sailing from Toulon. But Nelson had to put into port to repair his flagship, and Bonaparte put to sea. Nelson's ships were soon pursuing him, but passed him by in a fog without knowing it, and so went hunting after him in another direction. Thus Bonaparte got to Egypt, and landed his army and conquered the country, as we read on page 2286. But while he was there Nelson found the best part of the French navy at anchor in Aboukir Bay; and, having the wind behind him, he sailed with his smaller fleet half-way down the French line, with half his ships on one side of them, and half on the other, so that he got them between two fires; and all that evening and half the night the battle raged, and in the morning all but two of the French ships had either been taken or sunk. That was the great battle of the Nile, for which Nelson was made a peer. After that it was not easy for French ships to appear in the Mediterranean Sea at all, and Bonaparte, in Egypt, could get no more men or money or stores from France, so that he could not set about the great conquests of which he had dreamed, or bring his army back to Europe. Still, after a time he found a ship which took him back to France with a very few of his friends; and then he had himself made First Consul, which really meant that he was the absolute ruler of France. He succeeded in doing that because the soldiers were on his side, for the National Assembly did not at all like to give up its power. Things had not been going well with the French while Bonaparte was in Egypt. The Austrians were back in Italy, and he had to hurry off, taking an army, by a wonderful and very difficult march, over a great pass in the Alps, so as to appear when the Austrians did not expect him. He beat them again in Italy, and another general, Moreau, won the great battle of Hohenlinden. After that the Austrians sought peace once more.

NELSON AS A MIDSHIPMAN

But before there was real peace Nelson had to be at work again; for Bonaparte wanted to get the Danes to let France use their fleet against England. So Nelson was sent to the Baltic to get the Danish fleet handed over to him instead. There was another admiral, named Parker, over him, but it was Nelson who fought the battle of the Baltic, which made the Danes submit. The victory put an end to that plan of Bonaparte's, and after the Danes were defeated there was peace even between Great Britain and France for a little while.

For some time Bonaparte had taken to signing his Christian name, as kings do, instead of his surname, and in December 1804 had had himself made Emperor of the French. We must remember that he was not only one of the very greatest soldiers that ever lived, but was also a great ruler, and he did many good things for France during the time of peace. But he could not be content while England still ruled the seas and would not do his bidding; so it was not long before war was declared again.

Napoleon made a plan for a great invasion of England, but though England had no great armies to match his on land, he had no fleet to match hers on sea, and there was no way of sending his soldiers across the Channel so long as the British fleet was on guard. Then it was that Nelson won his last and greatest victory. The French admiral, Villeneuve, with a French and Spanish fleet, played a sort of hide-and-seek with him, sailing off to

NAPOLEON & WELLINGTON ON THE FIELD

The battle of Arcola was one of the most brilliant of Napoleon's victories. With three Austrian armies approaching him, he made a daring night march, and attacked them on swampy ground where cavalry could not charge. After three days' fighting, the French were victorious. During the battle Napoleon nearly lost his life. Seizing a flag, he rushed on to a bridge to rally his men, and was pushed into the river.

After the defeat of Napoleon's army at Waterloo was assured, and the Prussians, in hot pursuit of the French, had turned their retreat into a rout, the Duke of Wellington and the Prussian general, Blucher, met on the battlefield, and congratulated one another upon the victory that had been won, as shown in this picture by Daniel Maclise. The brunt of the battle had been borne by the British, who were tired out, and Blucher's arrival put an end to any hope that Napoleon might have had of rallying his shattered forces.

the West Indies, and then doubling back, in an effort to gain time to join forces with another French fleet, and so be able to command the Channel long enough for Napoleon to get his invading army across. But he did not succeed in joining the other fleet.

Then Napoleon saw there was no hope of invading England, and carried off his army from Boulogne to win the great battle of Austerlitz. Nelson went after Villeneuve and after he had followed him across the Atlantic and back, he found him with a great fleet, part French and part Spanish, at Trafalgar. Nelson's ships sailed down on Villeneuve's line, pierced it in two places, and treated it very much as the other fleet had been treated at the battle of the Nile.

This was the day on which Nelson ran up his famous signal, "England expects every man to do his duty," and set a glorious example which was gloriously followed. But before the victory was complete, which ended all hope of France resisting England on the seas, the hero himself had fallen, pierced by a bullet. He lived just long enough to know that his great task was successfully accomplished. So died one of the greatest sailors in history.

HOW NAPOLEON TRIED TO RUIN ENGLAND AND BECOME MASTER OF THE WORLD

Now, Napoleon knew that it was not by fighting battles that he would ever have the chance of humbling England, but he thought he could ruin her by preventing her from either selling or buying anything in Europe; and that was one reason why he wanted all Europe to bow to his will, besides the wish to make himself the mightiest emperor the world had ever seen. He made his own brothers kings in Holland and in Italy and in part of Germany—kings who would really be his subjects; and at last made one of them, named Joseph, King of Spain.

This, in part, was his undoing, for the Spanish people would not have a Bonaparte for their king, and rose up against him. The British sent an army to help them, and at their head was the great soldier who finally broke Napoleon's power in the last great fight of Waterloo. The strange thing is that Napoleon did not go himself to Spain to crush Wellington, but left the work to his marshals, whom Wellington out-generalled. But he himself thought it more necessary to make Russia obey him, when she was the only remaining country in Europe which did not fear him. That is why he went on that terrible expedition to Moscow, whence the lack of food and shelter forced him to retreat through the bitter winter weather, so that only a shattered remnant of his army ever returned home.

THE IRON DUKE WHO BROKE THE POWER OF BONAPARTE

The Duke of Wellington was only Sir Arthur Wellesley when he went to command the British army which was to help the Portuguese and Spaniards. He was born in the same year as Napoleon, and was exactly forty years old when he took up the Spanish command. He was a younger brother of an Irish peer, Lord Mornington, who was sent out to be Governor-General of India, and who afterwards became the Marquis Wellesley.

Arthur Wellesley went to India, too, and fought in the great wars there, first against Tippu Sahib of Mysore, and afterwards in command of British troops and sepoys against the Maharattas, when he won the famous battle of Assaye. For this great victory he was made a knight.

In after years men called him the Iron Duke. Let us look at his fine, firm face, with the great nose and the strong mouth: a man who could never be shaken out of his stern self-control. Long years after, men must have been moved as they saw the Iron Duke, now white-headed, break down and shed tears in addressing the House of Lords on the death of his noble friend, Sir Robert Peel. Hard and cold he seemed, but altogether just, and with never a hint of self-seeking.

HOW WELLINGTON BEAT BACK ARMY AFTER ARMY IN MANY FAMOUS FIGHTS

It was no easy task that he had in what is called the Peninsular War, when Napoleon's most skilled marshals came to fight him, one after another—Victor, and Masséna, and Marmont, and Jourdan, and Soult; when he could trust nothing to the Spanish soldiery, but had to depend for all real work on his own men; when one defeat would almost certainly have led to his recall.

Year by year he fought his campaigns, and beat off army after army in his famous fights at Talavera, Albuera,

FIGHTING THEIR BATTLES OVER AGAIN

The battle of Waterloo will always be known as one of the turning-points in the world's history. Here the power of Napoleon, the man who had changed the map of Europe, was for ever broken. And whenever Waterloo is spoken of, Wellington, the victor of Waterloo, will also be remembered. Here we see the Iron Duke, as Wellington was called, years after the battle, surveying the field of his victory that saved Europe.

With what different feelings from those of Wellington must Napoleon, after his exile to St. Helena, have recalled the mighty battle that sent him to his doom! Away in his rocky island home, guarded beyond the possibility of escape, he must often have sat on the lonely crag, as shown here, fighting the battle over again, correcting the blunders that led to his defeat, and wishing that the past was not beyond recall.

Fuentes d'Onoro, and Salamanca, until at last he sent King Joseph Bonaparte flying from Spain after the rout of Vittoria, and fought his way into the south of France, just when all the armies of Europe were closing in upon Napoleon, whose power had been all but destroyed in the fierce three days' battle of Leipzig, which men called the Battle of the Nations.

THE MIGHTY EMPEROR WHO BECAME THE KING OF A LITTLE ISLAND

The great conqueror had been conquered. He had cast aside his wife, Joséphine, that he might wed an Austrian princess; then he had suffered the awful disaster of Moscow; once more he had hurled himself against the combined Powers of Europe, and, in spite of a victory at Dresden, had been overwhelmed by their numbers at Leipzig. The lion was meshed in the toils; but the Powers of Europe suffered him to abdicate his imperial throne, and retire to the little island of Elba in the Mediterranean.

A twelvemonth had not passed before the world was startled by his reappearance in France. His old soldiers flocked to his standard; they were sent forth to crush him, but instead they joined his army—and the only nations that were at all ready to face him were the British and the Prussians. Both of these people were able quickly to place armies in Belgium or on its border, Wellington commanding the one, and stout old Blücher, whom folk called "Marshal Forwards," the other. If Napoleon could only crush them before Russia and Austria could take the field against him, he might once again be master of Europe.

HOW NAPOLEON FELL FOR EVER AND WAS BANISHED TO A LONELY ROCK

Napoleon tried his hardest to overthrow the armies of Britain and Germany, and he very nearly succeeded. He struck at a point just between Wellington and Blücher, and beat the Prussians in a battle at Ligny, while the British stood at bay at Quatre Bras. Now, the question was whether he could keep Blücher and Wellington apart till he had beaten Wellington. The "Sepoy General" took up his stand at Waterloo, and all day, throughout Sunday, June 18, Napoleon drove the masses of his troops up the slopes against the British lines, and all day the British drove them back, time after time.

At last, as Blücher and his Prussians began to arrive on the field, the French made their last desperate charge, and met their last desperate repulse. The British line swept forward, and the Prussians came thundering on their flank; the defeat became a rout, a wild flight: the army of Napoleon was shattered for ever.

When the fallen emperor yielded himself, none dared treat him generously; all feared him and distrusted him too much. He who had shaken the world with the stamp of his foot, and dazzled it with the flash of his sword, was banished to end his days on the lonely rock of St. Helena, far out in the mid-Atlantic Ocean. And in France the brother of the murdered monarch, Louis XVI., was restored to the throne to rule as king.

THE IRON DUKE, WHO SAVED FRANCE FROM THE VENGEANCE OF HER FOES

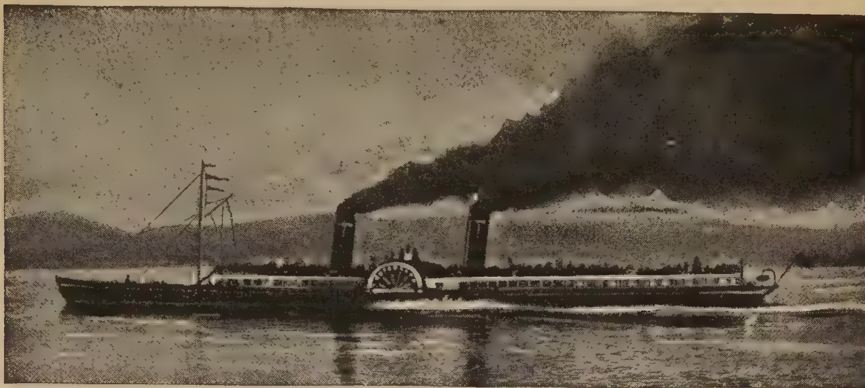
In those days the Iron Duke showed himself a wise and shrewd man, checking those who would have taken a fierce revenge on France for all the troubles Napoleon had wrought. But later he showed that even a wise man may have little understanding of the governing of a country like England, where, as in our own land, the people desire to have a voice in their own ruling.

Yet, for all that, he knew that there are times when the wise general will beat a retreat; and so, when the Tory party in Parliament came to look upon him as their chief, his most notable acts were just when he told them that they would do more harm than good by resisting changes on which he saw that the people were fully determined.

Waterloo had been fought and won nearly forty years before the great duke passed away, full of years and honors, loved by the British nation in his old age, as it had never loved him when all Europe was ready to do homage to the conqueror of Napoleon.

When he died in 1852, they laid him to rest, "to the noise of the mourning of a mighty nation," in St. Paul's Cathedral, and there they erected a splendid monument to his memory as a man who was one of the saviors of Europe.

THE NEXT MEN AND WOMEN BEGIN ON 4441.



WHERE DOES THE SMOKE GO?

CONTINUED FROM 4277

SMOKE is made up of a large number of different things, solid and gaseous. The solids are for the most part too large to stay in the air, and so, after a time, they settle. There is a lot of oil made when coal is burned, and so the black particles of carbon found in smoke are oily, and that is what helps to make them so dirty. Some of the gases are already quite burned when they pass off in smoke, such as carbon dioxide, and we know what happens to carbon dioxide in the air—whether it has come from our lungs or from a furnace that is not alive.

Other gases in smoke are not completely burned, and they get burned up in the air, forming more carbon dioxide, and also water, which is one of the things made by the burning of the hydrogen of coal, and is therefore always present in smoke.

ARE FLOWERS HURT WHEN WE PICK THEM?

It is very difficult to answer this question, not because we do not know the answer, but because it is not easy to use the ordinary words without giving a wrong notion of the facts. It all depends what the word hurt means; so much so that in one way we might certainly say No, and in another we might say Yes, to this question. We may be quite sure that the flower is not hurt as we are hurt by a pin-prick or a cut. The kind of feeling that we call pain is, in fact, a very high and lately developed and special kind of feeling. No plant of any kind feels pain. It is even certain that it is only among the higher types of animals that anything we may call pain can be felt; so there is no cruelty in picking a flower. But, on the other hand, we can be perfectly certain that some part of the plant feels the injury. What that feeling is like we could not say unless we could become a plant. That is largely true of all feelings: only those who feel them really know what they are like.

HOW DOES A FLOWER GROW?

All living things grow at some period or other in their lives, and the secret of growth is part of the secret of life itself, which men have not yet found out; so it is only possible to answer this question in part. We can say what are the conditions without which the flower is unable to grow. It must have light, water, air, and certain salts, containing certain elements, dissolved in the water which is sucked up by the roots. If these conditions are granted, the plant will obtain for itself the materials needed for building

itself up, and the energy employed in doing so. Not much could be said beyond this. All we know is that there is something in the life of the rose plant that determines that the flowers it bears must be roses and not lilies or wallflowers. Nor will any kind of outside change cause anything but a rose to be produced by the rose plant. The cells that contain the life of the plant are so made.

The same is true of every kind of animal and plant. Each has its own special structure, and will grow in its own special form. Exactly the same food may be given to the rose, to the lily, or to the acorn, and they will grow to be what they must; and exactly the same milk may be given to Marsie and to Marsie's kitten, to Tommy and to his puppy, and each will grow to be what its nature demands.

ARE LEAVES WATERPROOF?

The answer is both Yes and No, according to what we mean by waterproof. Usually that word means that a thing will not let water through it in either direction. That is true of waterproof clothes. But leaves and the skins of animals are only strictly waterproof in one direction. The skin or the surface of a leaf will allow no water to enter them. In both cases the body of the living creature is so arranged that the surface—whether leaf or skin—shall be the outgoing, not the incoming, channel for water.

If water could enter by this route, even after prolonged soaking, the whole arrangements for the circulation of water in the creature's body would be interfered with. When the surface of a leaf is carefully examined, we find that it has a sort of outer skin, really not so very different from ours. This is made of cells, the material of which has been changed, for this special purpose, into something which is very much the same as cork, and which water cannot penetrate from outside.

Rain is by no means bad for leaves, as it washes them and keeps them clean, thus keeping their surfaces clear for the purpose of breathing and for the use of the light that falls upon them. But the plant no more drinks by its leaves than we do by the skin; it drinks entirely by its roots. Water is able to leave the leaf, in the form of water-vapor, at various points, but water cannot enter there. Thus a leaf truly perspires, just as our skins do, and for the same purpose; and in certain states of the air, the water may become liquid, and lie in drops on the leaf. These drops look like dew, but are really the same as the drops on our skin when we have been running or taking any violent exercise.

WHAT IS THE MEANING OF THE NAME ENGLAND?

When we remember the origin of the name of England, we ought to know the celebrated story of Pope Gregory the Great, who, near the end of the sixth century A.D.—before he became Pope—saw some fair-haired English captives offered for sale in the slave-market in Rome. Their fair hair was, of course, very uncommon there, and looked very beautiful; and so he said: "Non Angli sed angeli," meaning "Not Angles but angels."

After the Romans left Britain, the island was invaded from the north by the Picts, and by the Scots. Both were Celtic people, but the Scots, who gave Scotland its name, had crossed over from Ireland some time before. On the south and east the island was invaded by three German tribes—the Jutes, Saxons, and Angles. Gradually the Saxons and Angles spread through the land as far as Wales on the west and north to the River Forth. The Angles settled in the east, and it was from this tribe that England received its name.

Though we still call the country England, the Angles form only a small fraction of the source of the English people to-day. The country gained, no doubt, in the long run, from all its invaders. In its people to-day there is represented not only English—in the strict sense—but also Saxon, Jutish, Danish, Celtic, Norman, Roman, and Scottish blood, to mention only its main elements.

WHY DOES WATER BOIL WHEN PUT ON LIME?

The answer to this question depends on a very interesting chemical process which is not difficult to understand. Water does not exactly boil when it is put on lime, but it is certainly true that the water is made very hot; and so our question really is: Where does this heat come from? Lime, or rather quicklime,

is a compound of the metal calcium and oxygen. It is therefore called calcium oxide, and each molecule that makes up this compound contains one atom of each of these elements; so chemists write it by this *formula* or sign—CaO—Ca standing for calcium and O for oxygen. If water reaches this oxide, the water and the oxide combine very powerfully. It is as if the quicklime drank up the water and slaked its thirst, and so we now call it slaked lime. This slaked lime is calcium oxide plus water, and its formula is simply the two formulas added together, CaO, H_2O. The best way of writing this is $Ca(OH)_2$. The small 2 means that there are two parts each of oxygen and hydrogen. As in most other cases of chemical action—just as when a fire burns—heat is produced by this slaking of lime, and that makes the lime and the extra water that is added very hot.

WHY DOES A CLOUD FALL AS RAIN INSTEAD OF IN A LUMP?

It is only quite lately that we have been able to learn the very remarkable answer to this question. We might suppose that, when the air cooled enough, the water-vapor, or some of the water-vapor, in it would be bound to turn liquid all in a mass and then fall "plump." But water cannot behave in this way, because there are certain conditions which must always be present when it turns liquid.

It is necessary that there shall be some solid separate point or particle of something around which the water-vapor can condense when it turns liquid. It seems to matter very little what the thing is, but there must be something, and the consequence is that rain falls in drops. It is the discovery of the cause of the formation of raindrops that enables us to answer this question. The particles that perform this service for the drops may be small or great. Oftenest, perhaps, they are visible specks of dust or dirt, and so on.

We have also discovered that the molecules making up the gases of the air are liable to be broken up in a peculiar way by the action of electricity, and raindrops can form upon these broken-up molecules. We shall not be able to learn a great deal more about the weather until we have more knowledge of the electrical happenings in the air.

DO WE GET A POUND OF ICE FROM A POUND OF WATER?

When we use such words as pound or ounce, we are concerning ourselves with the notion of weight; that is a different thing from mass, of course. The mass of a thing is the amount of stuff in it, and is just the same whether a thing is on the sun or the moon or the earth, though its weight would be very different in those three cases. Now, if we take a pound of water and turn it into ice, the mass of it will remain the same. We allow nothing to run away, and we add nothing to it, so we have there the stuff which we had before, and nothing but that stuff; and the only question is: Does it weigh the same when it is frozen as when it was liquid? That, in other words, is the question asked here.

The answer is that most careful experiments have been made for many years past on this very point, and they all go to show very clearly that gravitation is not affected in the slightest degree by any change of temperature, however extreme. The amount of stuff which weighed a pound when it was liquid water weighs neither more nor less, but exactly the same, when it is frozen. If, however, instead of asking this question about weight, we had asked one concerning volume, or size, the answer would have been quite different. For instance, we do not get a quart of ice, so to speak, from a quart of water, because the water expands, as it is frozen, to form ice; and so we get more than a quart of ice from a quart of water.

WHY DO SOME COLORS APPEAR DIFFERENT IN GASLIGHT AND IN DAYLIGHT?

The color of anything that gives no light itself, but shines by reflecting, or throwing back, to the eye the light that falls upon it, depends on much more than the thing itself. Of course, the thing itself is very much to be reckoned with, but as it makes no light itself, it plainly can only reflect the whole or certain parts of the light that falls upon it. It is creating nothing—only giving back to our eyes a certain part of what falls upon it.

Whether in gaslight or in daylight, the thing itself is the same, but its color is liable to change if these two kinds of light are not the same. Let us suppose that a thing is able to reflect only a

[illegible]

... which the eyes, un-... [illegible] It is possible, with ... [illegible] to make a ... [illegible] a thing ten thousand ... and it is even possible, by a very ... [illegible] and under special conditions, to see things or, rather, their shadows which are smaller than any [illegible] microscope can show.

[illegible] the atoms and ... of the molecules of which matter is made are [illegible] smaller than this. We ... [illegible] seeing an atom with the highest possible power of the microscope than we are with our own eyes ... so tiny are the atoms. Further, there is a natural limit to the ... [illegible]

size of the waves that make light is a fixed thing, and is such that no one will ever see an atom. Thus, the movements of the wood in the chair, or the atomic movements of matter in general, can only be seen by the mind's eye.

WHY CANNOT WE FEEL WITH OUR FINGER WHEN IT IS NUMB?

The feeling in the finger depends, like all other feeling, upon nerves. The nerves of the finger end in the skin in a number of tiny organs, only to be seen by the microscope, which, though tiny and never spoken about, really correspond exactly to the eye and the ear. The action of the ends of nerves and the organs at the ends of them depends very much upon their temperature. That is probably the chief reason why, in the higher animals, the temperature is fixed instead of moving up and down with the surroundings.

When nerves are made cold—as when the finger is numb—they cannot receive impressions at their ends, nor conduct them if received, and so we do not feel. This can often be applied when we wish to make a little cut, or something of the sort, in a finger, or some other part of the skin. If the thing is slight and quick, it seems a very great pity to make the person unconscious, so as to avoid pain, and it is much better just to numb the part of the skin in question, if we can.

Probably all the various things that are used for this purpose nowadays depend partly for their success not only upon what they do to the nerve itself directly, but also upon the fact that they lower the temperature of the skin where applied, and so interfere with the power of the nerves to convey to the brain that something which we call pain.

WHY IS IT THAT THE BAD AIR OF A MINE DOES NOT KILL THE MINERS?

The air of many a fashionable and world-famous great city shop, or of hundreds of thousands of bedrooms every night, is far worse than that of mines nowadays. Ventilation is one of the great problems of a coal-mine, and one of the very first that must be attended to. Year by year we go on cutting the coal away, and at the present time a year's increase in the amount taken is greater than the year's total was not so long ago. Thus the miner is always moving farther and farther away—perhaps a mile or more—from the opening; and wherever he goes a sufficient supply of air must go with him. The problem is, however, made simpler in one way, because electricity is nearly always used for lighting mines, and so, at any rate, the oxygen that would have had to be used up in the burning of any kind of non-electric lamp or candle is saved.

Failure of proper ventilation is very largely responsible for explosions in coal-mines, and possibly, also, for other accidents, through the bad effect of foul air on the mind, the watchfulness, and care of the miners. Since we have learned how important ventilation is in this respect, the standard has been much improved. An extremely expensive but very thorough way to get good air into coal-mines is to take down liquid air, which occupies very little space, and is rapidly turned into pure air ready for breathing. An arrangement has been made for carrying liquid air down by a rescuer in cases of accidents, where no one could say what kind of atmosphere he might meet in his attempt to save his fellow-workers.

WHY DOES NOT SEA-WATER MAKE FISHES THIRSTY?

Well, we might almost answer this question by another: How do we know that fishes are not thirsty? It is not at all easy to find out how much water fishes drink; but, like every other living thing, they require water, and perhaps they take a good deal. Certainly it is always at hand. We do not find that the muscles, for instance, of a fish contain higher proportions of salts than do the muscles of other animals; nor can we show any particular difference between the amount of salts in the body of a fresh-water fish as compared with the amount in the body of a salt-water fish.

We know that many fishes travel about in the course of their lives from fresh to salt water, and from salt to fresh, but no one is yet in a position to tell exactly what the fish does in these cases. It certainly is very clever to be able to adapt itself so well to such very different kinds of water. This can only mean that the organs of its body which are concerned with keeping the composition of the blood right are able, when occa-

much as it does. In Germany places have already been established where the best kinds of microbes for this purpose are grown, and can be sent by mail to the farmer for preparing his cream.

WHY ARE ANY COINS MADE OF GOLD?

There are many fairly good reasons why some coins should be made of gold. If a nation is to have a coinage made of a metal that is precious, gold is perhaps the best that can be employed. It is not too common; but, at the same time, enough of it can be obtained to meet this purpose. It has a very easily recognized appearance, and yellow mixtures of other metals can scarcely be confused with it, especially as it is so very heavy. It does not rust, and tarnishes hardly at all when it is exposed to air or moisture. It has the defect of being soft, so that pure gold coins would get rubbed away; but the addition of other metals to it makes it quite hard enough to wear for a very long time.

But at the present time it seems that we shall some day cease to use gold for this purpose. For one thing, it can be shown that the more civilized nations become, the less do they employ in the business anything that is of value in itself. In old days people used cattle and the like for their money, as our word *pecuniary*—which really means cattle-ish—tells us. But the tendency at present is towards using something that shall be simply a sign, like checks and bank-notes. One advantage of this is that we shall be able to use gold, which is very beautiful, much more freely than at present, to make beautiful things.

WILL THE MOON EVER FALL INTO THE EARTH?

This is a good instance of those many great questions in astronomy which we can answer in a way and up to a point, but not yet with certainty. The reason is that the answer to such questions depends upon the various forces that are at work in the world. If we were certain in any case that we knew all these forces, then we could be certain as to what would happen, for we know the laws of their working, and these laws are certain and never change. But, in fact, we usually know only some of the forces that are at work, and so we must be careful, because we never know whether there may not be others which ought to be reckoned with. However, judging by the forces that we do know, we are bound to suppose that some day the moon will return to the earth, which it left so many millions of years ago.

This belief largely depends upon the study of the effects of the tides which the various bodies of the solar system raise in and upon each other. The question has been much studied by astronomers, and especially by Sir George Darwin, who was a son of Charles Darwin, who taught us the history of the plants, animals, and man. We do not yet know all there is to know about the history of the moon, however, though we are practically certain that at the present time the moon is slowly traveling farther away from the earth instead of getting any nearer. But, so far as we can judge, in time it is bound to come back again.

CAN A MICROSCOPE SHOW US THE ATOMS MOVING IN WOOD?

The answer to this question is: Certainly not; but the question is well worth asking, because it serves to clear up a point that is often not understood. We are perfectly sure that if we could see the atoms or molecules of matter, whether solid, liquid, or gaseous, we should see them all in movement of one kind or another, varying according to the nature of the thing we are looking at, its temperature, its electrical state, and so forth. But, unfortunately, we cannot see these movements, and it is even certain that we shall never see them in any direct way.

People know that the microscope reveals many things which the eyes, unaided, cannot see. It is possible, with great labor and expense, to make a microscope magnify a thing ten thousand times, and it is even possible, by a very roundabout way and under special conditions, to see things—or, rather, their shadows—which are smaller than any straightforward microscope can show.

But, unfortunately, the atoms and most of the molecules of which matter is made are vastly smaller than this. We are practically no nearer seeing an atom with the highest possible power of the microscope than we are with our own eyes unaided, so tiny are the atoms. Further, there is a natural limit to the power of the microscope, because the

size of the waves that make light is a fixed thing, and is such that no one will ever see an atom. Thus, the movements of the wood in the chair, or the atomic movements of matter in general, can only be seen by the mind's eye.

WHY CANNOT WE FEEL WITH OUR FINGER WHEN IT IS NUMB?

The feeling in the finger depends, like all other feeling, upon nerves. The nerves of the finger end in the skin in a number of tiny organs, only to be seen by the microscope, which, though tiny and never spoken about, really correspond exactly to the eye and the ear. The action of the ends of nerves and the organs at the ends of them depends very much upon their temperature. That is probably the chief reason why, in the higher animals, the temperature is fixed instead of moving up and down with the surroundings.

When nerves are made cold—as when the finger is numb—they cannot receive impressions at their ends, nor conduct them if received, and so we do not feel. This can often be applied when we wish to make a little cut, or something of the sort, in a finger, or some other part of the skin. If the thing is slight and quick, it seems a very great pity to make the person unconscious, so as to avoid pain, and it is much better just to numb the part of the skin in question, if we can.

Probably all the various things that are used for this purpose nowadays depend partly for their success not only upon what they do to the nerve itself directly, but also upon the fact that they lower the temperature of the skin where applied, and so interfere with the power of the nerves to convey to the brain that something which we call pain.

WHY IS IT THAT THE BAD AIR OF A MINE DOES NOT KILL THE MINERS?

The air of many a fashionable and world-famous great city shop, or of hundreds of thousands of bedrooms every night, is far worse than that of mines nowadays. Ventilation is one of the great problems of a coal-mine, and one of the very first that must be attended to. Year by year we go on cutting the coal away, and at the present time a year's increase in the amount taken is greater than the year's total was not so long ago. Thus the miner is always moving farther and farther away—perhaps a mile or more—from the opening; and wherever he goes a sufficient supply of air must go with him. The problem is, however, made simpler in one way, because electricity is nearly always used for lighting mines, and so, at any rate, the oxygen that would have had to be used up in the burning of any kind of non-electric lamp or candle is saved.

Failure of proper ventilation is very largely responsible for explosions in coal-mines, and possibly, also, for other accidents, through the bad effect of foul air on the mind, the watchfulness, and care of the miners. Since we have learned how important ventilation is in this respect, the standard has been much improved. An extremely expensive but very thorough way to get good air into coal-mines is to take down liquid air, which occupies very little space, and is rapidly turned into pure air ready for breathing. An arrangement has been made for carrying liquid air down by a rescuer in cases of accidents, where no one could say what kind of atmosphere he might meet in his attempt to save his fellow-workers.

WHY DOES NOT SEA-WATER MAKE FISHES THIRSTY?

Well, we might almost answer this question by another: How do we know that fishes are not thirsty? It is not at all easy to find out how much water fishes drink; but, like every other living thing, they require water, and perhaps they take a good deal. Certainly it is always at hand. We do not find that the muscles, for instance, of a fish contain higher proportions of salts than do the muscles of other animals; nor can we show any particular difference between the amount of salts in the body of a fresh-water fish as compared with the amount in the body of a salt-water fish.

We know that many fishes travel about in the course of their lives from fresh to salt water, and from salt to fresh, but no one is yet in a position to tell exactly what the fish does in these cases. It certainly is very clever to be able to adapt itself so well to such very different kinds of water. This can only mean that the organs of its body which are concerned with keeping the composition of the blood right are able, when occa-

sion requires, to filter an excess of salts out of it very quickly. The same is true of our own bodies, fortunately for us, as we often take food and drink containing an excess of various things which certainly must not stay long in the blood. On the other hand, we are not adapted to keep the composition of the blood right if we drink nothing but sea-water, as fishes can without harm.

WHY DOES THE DOCTOR FEEL OUR PULSE WHEN WE ARE ILL?

What we call the pulse is the beating of an artery which happens to lie just over a piece of bone at the wrist, and the beating of which is therefore very easily felt. The pulse, felt by a trained finger, gives a great deal of information. In the first place, it tells how often the heart is beating in a minute, and that needs no training to count; but it also tells how strongly the heart is beating, and how regularly. It tells whether the heart is strained or laboring or over-excited, or just beating easily, as it ought to do.

The pulse also tells what is the state of the arteries throughout the body, as to whether the muscles in their walls are tightly contracted or lax; and it also tells—though this requires long training to feel—not merely how forcibly the heart is beating, but how much pressure there is inside the blood-vessels of the body between the heart-beats. This question of blood pressure is enormously important, for it affects the working of every part of the body. The temperature can also be told from the pulse, as we read on page 4018. Thus, of all the single things that a doctor could possibly do, feeling the pulse tells him more than any other; more even, on the whole, than looking at the patient's face; vastly more than taking his temperature or thumping him, or even listening to his heart-beats.

WHY DO CHERRIES AND PLUMS HAVE STONES?

Perhaps we should have done better to ask: Why do stones have cherries and plums? These things are beautifully made for a great purpose, which is to reproduce the race of plants to which they belong. The all-important part of the cherry or plum is not the part we eat, but the kernel inside the stone. It is this that the new plant will grow from if it gets a fair chance; and the rest of the fruit exists in order to give the kernel, or seed, a fair chance. First, there is the hard part of the stone, which protects the living seed inside it from any injury, but which is so made that it can quite easily be split open when the kernel inside it begins to grow. Then there is the fruity part, for the sake of which we prize the cherry or the plum.

Now, birds prize this just as much as we do, and that is why it exists. Although our liking for the fruit does the plant no good, the liking of the birds for it is just what it requires. The bird takes the cherry for the sake of the fruity part, and carries it away, and then probably drops the stone in some place where it may be possible for the seed to grow. Lastly, the skin of the cherry or plum largely succeeds in protecting the fruit from insects. So now we begin to see that there is a very good reason indeed why plums and cherries should have stones. Other fruits, we know, have no stones, but they have something else, pips or seeds, instead.

HOW DOES ALCOHOL AFFECT THE BRAIN?

Alcohol belongs to the class of those chemical substances which pass very quickly and easily through any obstacle, such as the wall of a blood-vessel, and so on. Thus, in a very few moments from the time when alcohol is swallowed, it enters the blood, and then is carried in less than a minute to the brain. There it passes out through the walls of the capillaries, or hair-like blood-vessels, and meets the matter of the brain itself.

Careful work is now being done to find out exactly what chemical changes go on when alcohol meets nerve-tissue, and especially nerve-cells. At any rate, it is now clearly proved, quite contrary to what most people used to think, that alcohol stops the action of the nerve-cells which it affects; and the constant rule about its action is that it always first affects the highest nerve-cells, those which are newest in the history of the race; and after them it affects lower types of cells in their order.

Thus, the person may be unconscious and all the rest of his brain quite thrown out of action, and yet the lowest and oldest part of it, which directs his breathing, may be working perfectly. Various

effects of all this are seen in different people, according to the different quality of their brains. The first effect is usually to make the person appear as if he had taken something to render his brain more active, and that is why most people still call alcohol a stimulant.

The explanation of this is that the highest cells of the brain are those whose business it is to control the rest—such as those by which we talk, those that act when we laugh, and so on. Therefore, when the controlling cells and the cells whose business is judgment and keeping guard are thrown out of action, we talk and laugh more freely and quickly and easily.

It is not possible here to say much about how alcohol affects the brain when too much of it is continually taken. It destroys the nerve-cells and causes the overgrowth of the substance that lies between them. This means the eventual destruction of the mind.

WOULD THE EARTH SEEM TO BE UP IN THE SKY IF WE WERE ON THE MOON?

The answer to this question is Yes, difficult though it seems at first to understand how this can be so. Yet it can be understood. The earth is a ball, as we know, and anyone looking out from the surface of that ball gets the notion, of course, that he is in the center of all things, and that they are hung in the sky on all sides of him. We see things up in the sky, and not down in the sky, because the earth interferes with our view. If the earth were transparent, we should see the sun, the moon, and the stars *down* in the sky, even right underneath our feet, just as we see them *up* in the sky.

This must be true not only of the earth, but also of any other of the heavenly bodies. The case is the same for all of them. This teaches us that up and down have no real meaning in themselves, but merely refer to our point of view. The earth, seen from the moon, would appear far larger than the moon does to us, and correspondingly bright. There would be no mistaking the difference between land and ocean. Through telescopes, such as we have, the largest buildings of a city could be made out. The greatest difference would be, perhaps, that an observer on the moon would so often find the details of the earth hidden by clouds. As the moon has no atmosphere, or almost none, her face is never clouded to our view; not even to the very slight extent that Mars sometimes is. But anyone on Mars or the moon would wonder what it was like to live on a world so often covered with thick clouds as ours is.

WHAT DIFFERENCE WOULD IT MAKE IF THE WORLD WENT THE OTHER WAY ROUND?

This question may have two meanings, for the earth goes round in two ways. It goes round the sun and it spins round on its own axis as it does so. If either or both of these movements were reversed, there would be no consequences of any particular importance. We should still have night and day, and the seasons, which are the results of the present movements as we have them now. Of course, serious consequences would happen if the earth's present movements were suddenly reversed, but that is another question.

The direction in which the world goes round matters a very great deal in the attempt which we are bound to make to interpret the world in which we live and the history of it.

DOES IT HELP US TO KNOW THE WAY THE WORLD TURNS ROUND?

The fact that the sun, the earth, and those planets we can observe all spin upon themselves in the same direction, and that all the planets revolve round the sun in the same direction, which is also the direction of their spinning, is of vast importance in guiding us towards true notions of the history of the solar system to which we belong.

This great fact teaches us that all the motions we observe in the solar system have a common origin. They are, doubtless, the present representatives, so to speak, of the spinning of the spiral nebula from which the solar system was formed. There are one or two apparent exceptions to the rule, notably the motion of one of the moons of Saturn, which revolves around the planet in the reverse direction. Such a remarkable case makes it probable that this moon has a special history, and at one time it may very likely have been independent of Saturn, and then caught by the planet's power of gravitation.

THE NEXT QUESTIONS ARE ON PAGE 4481.

THE RIGHT WAY TO PLAY LAWN-TENNIS

Beginners sometimes hold their rackets like this, but it is incorrect for any stroke; they should be held at the end, just above the button.

This is the correct way to hold the racket to hit the ball when it comes to the right hand of the player. Note the position of thumb and fingers, and also of the head of the racket.

In the correct position for the ordinary underhand service the left foot is in front, and the racket is swung back in a straight line with the arm.

Here the racket is swung ready to put a screw service on the ball. The strings cut the ball from left to right as the racket comes forward.

In this picture we see the right grip of the racket for the backhand stroke, used in hitting a ball coming on the left hand of the player.

This is how to perform the "round-arm smash," a useful stroke with which to "kill" weak net balls. Notice the free action, which should always be striven after in hitting.

This is the wrong way to hold the racket for a backhand stroke. The position is cramped. The thumb should not be in front of the handle.

THE GAME OF LAWN-TENNIS

CONTINUED FROM 4295

LAWN-TENNIS is an outdoor summer game, which is becoming more popular every year among both boys and girls. Only two or four players are needed for a game, and it can be played on the garden lawn if the latter is sufficiently large and level. If we are not fortunate enough to possess such a lawn, we can play in the parks, most of which have specially prepared and marked-out tennis-courts, with nets provided. Should we wish to use our own lawn, the grass must first be cut quite close to the ground and well rolled. The court is then marked out with straight white lines about two inches wide, in accordance with the plan and the measurements in the illustration.

It is not necessary for the beginner to pay a very high price for a racket, but he must see that the strings are taut, and the handle comfortable to grip. Its weight should be twelve ounces for a boy or girl of thirteen, and it should balance at the screw. A game between two is called a "single," and a game played by four is called a "double."

We will first deal with the "single" game. Before starting, the net must be raised to the height of three feet in the centre, and the players should toss for choice of side or service. If the winner chooses the side, the loser serves, or the winner may elect to serve, and then the loser chooses the side. The object in the game is to hit the ball into our opponent's court so as to make him fail to return it into our own court. Every time he fails it adds to our score, and every time we fail it adds to his score. The server must succeed, too, in hitting the ball over the net into the service court in one of two strokes, or his opponent scores a point.

The first point won counts 15, the second 30, the third 40, and the fourth a game. When both players reach 40 it is called "deuce," and a player does not add a game to his score until he wins two points in succession, the first being won when the ball is served from the right-hand court, and called "vantage in." It is "vantage out" if he loses the first point, but "deuce" again if he wins the next point. The server must stand behind the base line to the right of the centre, and throwing up or dropping the ball with the left hand, according to whether serving overhead or underhand, strike it with the racket before it reaches the ground, so that it shall fall in the right-hand service court on the other side of the net. Should the ball fall into the net, or outside the service court, the service is called a fault, and he tries again. If this service, too, does not fall into the service court, the receiver scores a point.

The receiver should stand somewhere near his base line ready to hit back the ball while in its first bounce. In this first stroke he is only allowed to hit the ball in this way, but after this stroke both players may hit the ball before it bounces, or "volley" it, as it is called. If the player lets the ball bounce a second time, his opponent wins the point. The receiver may return the ball into any part of his opponent's court, and the server, in returning it, may this time hit it into any part of the court. The two players hit the ball to and fro over the net to each other until one fails to return the ball within the opponent's court.

When the first "fifteen" is lost and won, the server delivers his second service from the left-hand side into the service court diagonally opposite him, and the receiver also moves to his left-hand side.

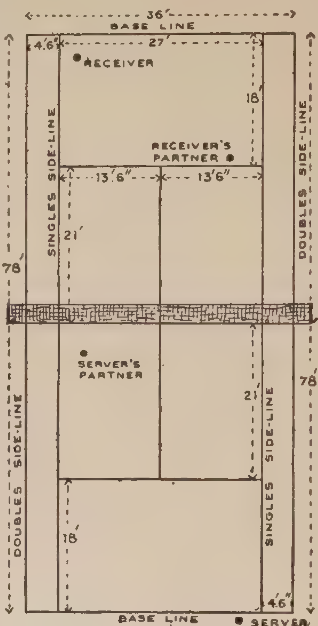
On the completion of the first game the receiver becomes server, and the players serve in turn until one of them gains six games, which count as one set. Should both players count five games, they may decide to play on until one of them is two games ahead of the other.

It is most important that we should hold our racket correctly. For serving and hitting the ball when on our right hand—the forehand stroke—we should grip the racket firmly at the end, the button just projecting beyond the little finger. For hitting a ball coming to our left—the backhand stroke—it is best to move our thumb so that it points along the length of the racket, and with some players the latter is slightly

twisted round in the hand. The essential thing to remember, however, is that the centre of the racket should meet the ball at right angles.

There are two ways of serving, the underhand and the overhead. In the easier underhand service the racket should be held firmly in a straight line with the hand and arm from the shoulder, and swept like a pendulum by the right side of the player, hitting the ball, which must be dropped into its path from the left hand. The movement should not stop immediately the ball has been struck, but the racket should follow the ball's path. It should, indeed, be a general rule in playing that the bat follows through its stroke, as much more certainty is given to the stroke, and a much freer action is thus gained.

In the overhead service the racket is carried behind the head, the shoulder being back and down; the ball is thrown up above the right shoulder about three or four feet, and the racket is then swung over so that the centre of the racket hits the ball as high above the head as possible. The left foot should point to the net, and the right foot should be almost at right angles to it, and the body should also be slightly turned away from the net. The greater weight of the body, which at first is on the right foot, becomes transferred to the left as the ball is hit. The racket should always follow through towards the left knee. We should rather make the mistake of sending the ball over the service line than hitting it down into the net. A ball falls naturally, and we should first endeavor to hit at a spot about a yard or so above the top of the net. The power of imparting twists, swerves, and screws to the ball comes naturally to most players after a few months' practice, and is obtained by drawing the surface of the strings across the ball as it is being hit. The server should make certain of sending an accurate second service, should the first one be a fault. Variety of pace and placing should be aimed at more than mere fast pace.



Plan of a lawn-tennis court.

The opponent, or receiver, should stand at the distance behind the service line where he expects, from experience of the server, that the bouncing ball will have begun to drop to the ground. He should avoid having to hit the ball as it rises to the top of its bounce. Half-volleys in tennis are the most difficult balls to return, and to be forced to take a ball on the half-volley is generally a sign that the player is in a wrong position—his aim should be to avoid having to play this stroke. He should be satisfied with getting the service, especially a hard one, back with a good length, that is to say, to fall near the base line. Every player should hit the ball with a firmly-held racket, keeping his arm as free as possible. His racket should meet the ball rather than let the ball meet the racket. He should be sure to time the ball accurately, and put weight into his stroke from his shoulder and body, and he should keep his eye on the ball until it is right on the racket. If his opponent is running up to the net, it is good policy to lob or hit the ball gently up over his head and out of his reach. Beginners should hit the balls after they have bounced, and make sure of a good length and accurate direction. Later they should practise volleying, and this can be done against any blank wall.

In volleying, the beginner should always try to take his low volleys with the head of the racket above the wrist, and to get his feet in the right position, thus: for a low forehand volley his left foot should be forward, for a backhand volley the right foot should be in advance. For overhead volleys very careful watching is necessary, and any easy balls hit as hard as possible so as to "kill" them.

In play we must always aim at hitting our balls well out to the base lines rather than hit them gently just over the net. We must always remember, too, to start at once for our ball, and not to wait until it is over the net before going to it.

In tennis we must learn to be very nimble indeed, and to recover our balance and position at once, especially when we have run back to take a lob over our head. Finally, to play well, it is absolutely necessary in such a quick game as tennis to concentrate one's whole mind on the game, and never to play slackly for an instant.

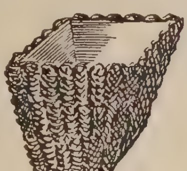
There is no difference in the scoring in a "double," but a larger-sized court is used, and the side lines of the single court are only used as boundaries to the service courts. Partners serve in turn thus: W and X are playing Y and Z. W serves, then Y, then X, and lastly Z. Z stands in the right-hand court for W's first service, while X is on W's left. For the second point W changes sides in his court with his partner, X, and serves from the left-hand court to Y. On the completion of the game W stands to the right-hand side of the court to receive Y's first service. Only the server and his partner change their positions. In "doubles" it is the object of each pair of partners to beat the opposing pair, and they must help each other to this end as far as possible. It is best to decide that each should have the balls that come on his side of the centre line. Another way to play, which is not quite so useful, is for one player to take the balls that fall near the net, and his partner those that fall near the base line.

EASY AND USEFUL RUSTIC CARPENTRY

IT is less expensive to make many articles of rustic carpentry for the garden than it is to purchase the factory-made or shop-made articles that serve the same purpose, and that do not look nearly so appropriate to their surroundings. If we look at the large pedestal flower-box in picture 1 we can see that this work is eminently attractive in appearance, and it is comparatively easy to do. For the flower-box in question we first make the box itself. This is made of plain boards—four of them—from any old packing-case that we are fortunate enough to possess. The four should be, say, 15 inches wide at the top, 15 inches deep, and an inch thick. But the sizes are not important so long as all four pieces are the same size.

The bottom should be square and not less than one inch thick, its size being suitable for the bottom or smaller end of the box. Its edges should be trimmed or planed to a bevel so as to fit the sides accurately. We should make four or five half-inch holes in the bottom —not in the centre—to carry off the water which may accumulate in the box, and which, if left, would turn the earth sour and kill any growing plant. This part of the box, when made, will resemble that shown in picture 3.

1. Rustic flower-stand.



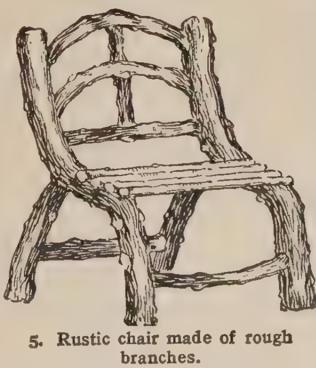
2. Pine-cone decoration.

3. The plain flower-box.

4. Virgin cork decoration.

Now we want the centre post, which should be a piece of natural wood from three to five inches thick and about three feet long. It should be sawn off straight across both top and bottom. If there is any difference in the thickness of the wood, we make the thinner end the top. We put the box that we have made on the top of the post, in the centre, and put several good long nails right down into the post. About three nails, each five or six inches long, will do well enough. Next we put two cross-pieces for a base, checking them in the middle if necessary. These pieces should be about the same thickness as the upright post, but may be a little thinner. Long nails are put right through where these pieces cross up into the bottom of the post. Now we nail on the supporting pieces which join the feet and the post, choosing bent pieces that lend themselves to our purpose; or, if the pieces happen to be straight, we must saw them off at one angle thereby making it easy to nail them on at the spots where they fit. We can now decorate the outside of the box. We nail split branches, about one inch thick, round the top and bottom edges of the box, and up each of the four corners. The sides of the box we can fill in with smaller split branches, after which we have, at no expense and with little trouble, completed a very presentable piece of garden furniture that will hold a large plant. In picture 2 is shown a box the sides of which are ornamented with pine-cones split in two halves lengthwise, and in picture 4 is seen a box with virgin cork ornamentation. Either of these is easily applied instead of split branches. Before putting a plant into our flower-pot, we ought to put at the bottom a layer of stones, broken bricks, or pieces of broken crockery, as this enables moisture to drain from the roots. No plants are healthy if there is no means by which the water may run away from their roots.

Of course, if we use the flower-stand as described, it must be set in a place where any water that may be dripping through the holes will do no damage. If placed in a tiled conservatory or porch, or in the open, it would be all right, but in a drawing-room or living-room it would probably spoil the carpets. If we want to change the plant frequently, we can put a square-shaped flower-pot inside the flower-stand. then, when we wish to remove the plant, we simply take this inside pot and put in another. The last picture illustrates a rustic chair made of oak branches, the crookedness of which makes them very suitable for chair work. After reading the description of the flower-stand, any boy will be able to make the chair without detailed particulars, and if he is successful in this he may go on to tables, garden seats, and even rustic summer-houses, all of which are both picturesque and useful. The best time for work of this sort is in the autumn, when growing wood is drier than at other times, for it then contains much less sap. It must be remembered that wood with a covering of bark is liable to be the home of insects, so that in time the bark falls off as the wood dries. For this reason it is very much better to use wood that has lain exposed until the decayed bark has fallen off. By doing this we avoid the unsightly appearance that rustic work attains when the wood sheds its bark.



5. Rustic chair made of rough branches.

FRACTURES, DISLOCATIONS, AND SPRAINS

A FOURTH LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM PAGE 4289.

A FRACTURE of the skull should always be regarded as a serious matter by those who render first aid, owing to the possibility of the brain being injured. The upper part of the skull is usually fractured by direct violence, as by a blow on the head, or by the head striking the ground or some hard object during a fall.

Fractures of the base of the skull are caused indirectly by a fall upon the head or feet or lower part of the spine, or by a blow upon the lower jaw. The signs of a fracture of the base are unconsciousness and the issue of blood from the ears or nose. In such a case it is essential that medical aid be obtained at once, but in lifting the injured person and carrying him to a doctor's the greatest care must be taken to support the head, and by means of a well-arranged coat, used as a pillow, to prevent it from rolling about from side to side.

How to bandage a fractured jaw.

When the upper part of the skull is fractured, there is frequently considerable swelling, and, sometimes, a wound allowing the bone to be seen. If the injury is a bad one, unconsciousness will come on more or less rapidly, and if it is very bad the unconsciousness will be immediate. In all cases of injury to the skull resulting in unconsciousness the patient should be kept thoroughly warm, any flow of blood should be stopped, tight clothing should be gently loosened, the free access of fresh air should be secured, and no food or fluids should be given while unconsciousness continues. When consciousness returns, water may be given, and the patient must be warned against any movement.

Handkerchiefs used as bandages for the face.

When the lower jaw is fractured, there is great pain, the patient's mouth remains open, he is unable to speak or move the jaw, the teeth are uneven, and there is bleeding from the gums. In such a case, with the palm of the hand raise the lower jaw into position, place the centre of a narrow bandage under the chin, take one end over the top of the head, and cross the two ends at the angle of the jaw, as shown in the first picture. Then carry the long end round the chin, and tie the two ends of the bandage at the side of the face; or, if no bandage is available, two handkerchiefs may be used, as in the second picture.

A fall on the hand or arm very often breaks the collar-bone, and the result is inability to raise the arm above the shoulder and a leaning of the head to the injured side. This is a common accident on the football field. The broken ends of the bone can usually be felt overlapping. To render aid in this accident, remove the patient's coat, make a large soft pad, and place it in the armpit; then, while the shoulder is kept well back, the forearm should be bent up and supported in a sling. To make the sling for a fractured collar-bone we take an open triangular bandage, and, placing one end over the uninjured shoulder, let the bandage hang down in front over the injured arm, with the point reaching beyond the elbow. The lower end of the bandage is now passed under the arm, across the back, and the two ends are tied on the sound shoulder. The point is folded over the elbow of the injured limb and pinned down as in the third picture, another bandage, folded broad, being tied fairly tightly round the body and elbow as shown.

Sometimes a person is so unfortunate as to break both his collar-bones at one time. In this case a narrow bandage should be tied round each arm, as shown in the fourth picture, and the ends passed across the back and round the body, and then tied together in front, as in the fifth picture. Before the bandages are tied in front, the two forearms should be raised, with the hands rather higher than the elbows, and they should be supported in the bandage. The purpose of the bandages tied to the arms, just below the shoulders, is to keep the shoulders well back. This gives relief to the patient, and prevents the broken bones from doing any damage.

In a case of fractured shoulder we place a broad bandage under the armpit of the injured side, carry the ends over the sound shoulder, and, taking them round, tie under the sound armpit. Then we support the limb in a sling.

A fracture of the spine is very serious, and often causes instant death. If the patient lives, he must be lifted very carefully and without the slightest jolt on to a stretcher, covered with garments to keep him warm, and carried at once to a doctor's.

When the ribs are fractured, the patient is unable to breathe properly or to cough, owing to great pain, and if the hand be placed over the injured place and a deep breath is taken, a grating of the broken bone or bones will be felt. The ribs most generally broken are the sixth, seventh, eighth, and ninth, and the fracture is usually about midway between the breast-bone and the spine. Fracture of the lower ribs on the right side may injure the liver, and cause

blood to be coughed up. If the fracture is a simple one, and no internal organs are injured, the treatment is to place a triangular bandage folded broad round the body, and tie it on the sound side. It is even better to fasten two bandages in this way, one above the other and overlapping. If triangular bandages are not available, a folded towel may be used, and fastened with safety-pins. The arm on the injured side should be put in a large sling. If a roller bandage can be obtained, it is even better than the triangular, and when rolled round the chest, from below upwards, gives great ease and comfort to the patient.


Method of bandaging for a broken collar-bone.

When the breastbone is broken, all tight clothing must be loosened, and the patient kept warm and quiet, in as comfortable a position as possible, until a doctor arrives.

One other kind of fracture must be mentioned, although it is rarer than the others that have been referred to—that is, a fracture of the pelvis. The patient will be quite unable to stand, and will not be able to move the lower limbs without intense pain. The danger of injury to internal organs is great, and the patient must be laid in a comfortable position, and have a broad bandage tied round the hips sufficiently tightly to give support without pressing the broken bone against the organs. If the injured person is moved, he must be lifted upon the stretcher with the greatest care, but it is better to bring the doctor to him than to take him to the doctor. Even when no bones are broken a person may suffer a dislocation—that is, two or more bones may get out of place. Dislocations of the lower jaw, the shoulder, elbow, and fingers are by no means uncommon. There is great pain near the joint, with loss of power in the limb, and frequently swelling of the joint, which sometimes becomes fixed. Only a qualified doctor should attempt to replace the bones, but we can help the patient by supporting the limb on pillows or coats, by very gently applying cold-water pads to the injured joint, and by following these with hot-water dressings.


How to bandage when both collar-bones are broken.

Another quite common injury is a sprain. This is frequently caused by a sudden jerk or wrench, which causes the ligaments round a joint to become stretched, or sometimes even torn. There is a great deal of pain at the joint, with swelling and much color.

The ankle is the joint most frequently sprained. If the injury occurs out of doors, a bandage should be bound over the shoe. Place the bandage under the foot, bring the ends over the instep, and then bind round and round the ankle, fixing it firmly. If the bandage be moistened after it is tied in position, it will be tightened and become more effective. This outside bandage will enable the patient to move more easily to a shelter. The shoe and stocking should then be removed in the proper first-aid manner, and cold-water dressings should be applied to the joint, which must be placed in a comfortable position. If the cold water does not give relief, hot-water dressings may be used. This treatment is for a sprained ankle; sprains of the other joints may be treated in the same way as dislocations.

Strained and torn muscles are not uncommon. They cause much pain and weakness. The patient should rest in as easy a position as possible, and heat—applied either by hot-water bottles or hot-water dressings—will relieve the pain.

Very often a fall or a blow that is not sufficiently severe to cause a fracture may give rise to hæmorrhage, or bleeding underneath the skin, but without breaking the skin. This is called a bruise, and, if it is a severe one, may cause much pain and great swelling and discoloring of the skin. A black eye is a familiar example of a bruise. The best treatment is to apply cold-water dressings to the place, or better still, if ice is available, the ice should be applied.

Before closing the lessons that deal with fractures and their treatment, there are one or two points upon which too much stress cannot be laid. When the accident has happened, no attempt whatever must be made to remove the patient until the broken limb has been bandaged with a splint, so that the bone is fixed and the broken ends are unable to do any further damage to the flesh or blood-vessels near them. To some of us it may seem only a small thing to move a patient from the roadway to safety on the pavement, or from the actual football ground to a place somewhere at the side, but such movement before the limb is bandaged with splints would be most serious and very painful, and might even be disastrous. Then, while the bandages and splints are being prepared, the broken limb must always be supported and kept perfectly still, and, lastly, if the leg should be injured it must always be straightened very carefully by pulling before the bandages are finally tied.

CONTINUED ON PAGE 4616.

WHO ARE THESE PEOPLE?

A CHARACTER PUZZLE GAME FOR BOYS AND GIRLS

IN the following game the character of some persons mentioned in THE BOOK OF KNOWLEDGE is described. Someone reads the description aloud, and the boy or girl who gives the greatest number of correct names wins the game. It is best to write the names on a slip of paper, so that every one who is playing has an equal chance. The solutions will be found on page 4500.

THE MAN WHO PREACHED HAPPINESS

1. There was once a handsome boy who loved fun and amusement. He thought of little else except how he and his companions could enjoy themselves. Yet he was generous, and often gave gifts to others. Animals knew he was fond of them, for his horse showed pleasure at his appearance, and birds came at his call to perch on his shoulders. As he grew older, he had more serious thoughts of the world about him, and puzzled over his own existence till he came to realize that love—love to mankind, to the birds, and the beasts, and the flowers, and, above all, to the good God and Father of all—was the thing of supreme importance. So he refused to dress in costly garments. He gave away all he had, and went about speaking kind words and doing good actions, trying to teach people the real secret of happiness.

A RULER OF ENGLAND

2. As we look at the portrait and think of this man, we can understand how people ran to do his bidding, for he said what he thought right, and to him speech meant action. The man knew his own mind and his own power. He possessed no polished manners or courtly graces, but he had a sturdy self-reliance and strong will-power that was easily stirred to right an injustice or to defend his home, his country, or his religion. Yet, like other men of strong character, he showed a tender heart to the weak and young, made a companion of his little granddaughter, and was very good to his feeble old mother. Some people say he was cruel, forgetting that leniency is sometimes great unkindness, and that a surgeon often has to inflict pain in order to cure.

THE MISER WHO HATED A GOOD MAN

3. We picture before us a repulsive man, with black hair, ugly face, and claw-like hands. He grabs all the money he can and hoards it up. His heart is full of envy and spite against those who are generous. He once loved his wife; but now no one, not even his daughter, really loves him, because, though he has the power to do good that money gives, his mind is getting narrower and his soul is becoming dwarfed. He lends money at high interest, which he extorts to the very last farthing. Some people have been unkind to him, and have despised him for his nationality and race; but, instead of pitying and forgiving them, he becomes more self-centred, and harbors revenge. He tries to outwit others by cunning and lying, hardens his heart, refuses mercy, and plots against the life of another. But when truth and goodness are too wise and too strong for him, he shows himself an abject miser, and says he would rather die than give up his worldly wealth.

THE MAID WHO LED AN ARMY

4. There was once a maid who lived in the meadows tending sheep, whose eyes rested on the beauty of the blue sky and soft, snowy clouds, and whose ears listened to the song of the lark and the murmur of the brook. Her thoughts were beautiful, too, and pure as an innocent child's. She saw lovely visions of good and glorious beings who talked to her and helped her to do right. Her country had been conquered by the foreigner, and she mourned the fate of her dear native land. One day, when she was musing in the fields it seemed to her an angel called to her to arise and save her country. Now, she was only a simple, ignorant maid, yet from that moment so strong a determination to help her country and secure its freedom filled her whole mind that she banished all thought of herself. And she was steadfast to her resolve, so that battlefield, hardship, insult, suffering, and imprisonment were powerless to break her spirit, until the enemies of her country wickedly burned her at the stake.

THE GIRL WHO NURSED HER DOLLS

5. A little girl used to be very fond of her dolls, and pretend that they were ill and wanted nursing. She loved animals, too, and liked nothing better than tending sick and feeble creatures. As a child, she cared for her dolls and pets; as a woman, she spent her energies in nursing. Brave and merciful, she went hundreds of miles away from home to care for the wounded on the battlefield. She found things in a terrible state. Soldiers who had been badly injured by shot and shell were lying on the hard, cold ground. The attention that they received was of the roughest. They were dying in scores for the want of proper nursing and nourishment. With an energy that was simply wonderful, she set herself to alter it. She succeeded in her purpose, and through her great efforts she has robbed modern warfare of many of its terrors. She showed herself unselfish and generous, for the money people sent her as a present she gave to found a training home for nurses.

THE SHEPHERD BOY OF THE EAST

6. There lived in the East a shepherd boy who made sweet music and wrote lovely poetry. His mind was filled with great ideas about the goodness of God and the beauty of Nature. At times he was happy and glad to be alive; but sometimes he grew depressed and melancholy, and prayed God to overcome his enemies. Yet his spirit always rose, and he became more hopeful. He was capable of doing mean and wicked things, but he repented so bitterly that we are told he was a man after God's own heart.

SOME PUZZLE RHYMES AND VERSES

ALL kinds of puzzles may be worked into rhymes and verses, and it is a very interesting pastime for a rainy day or for a dull evening to solve such puzzle rhymes, and still more interesting to make up original verses of this kind.

For instance, here is a puzzle rhyme:

What is the word referred to in this little verse?

First a *c* and a *t*, last a *c* and a *t*,
With a couple of letters between,
Form a sight that our eyes are delighted to see,
Unless in their sight it is seen.

Here is another similar verse telling how to spell a certain word:

Inscribe an *m* above a line
And write an *e* below,
This woodland flower is hung so fine,
It bends when zephyrs blow.

Dr. Whewell, the great mathematical scholar, once wrote out the following four lines, which can be read as a verse of rhyme. Let us see if we can understand it.

O O N O O
U O A O O I O U
O N O O O O M E T O O
U O A O I D O S O
I O N O O I O U T O O

When we have solved this curious puzzle, we should try to invent some other clever problems of the same kind.

BURIED NAMES

Names may be buried in verses, and it is interesting to dig these out. In this stanza of four lines are buried the names of four animals—that is, the names of the animals are found in the verse spelt properly, the letters running one after the other in their right order.

Poor wretch! a moisture filled his eye,
"Do not rebuff a lonely boy,"
Said he, "If ere I sink and die
Your smile, O! pardon will be joy!"

Here is another stanza in which are buried the names of eight British poets.

The sun is darting rays of gold
Upon the moor. Enchanting spot!
Whose purple heights, by Ronald loved,
Up open to his shepherd cot.
And sundry denizens of air
Are flying, aye, each to his nest;
And eager make at such an hour
All haste to reach the mansions blest.

Who are these eight poets?

In this stanza there are hidden the names of four fruits. What are they?

Go range through every clime, where'er
The patriot muse appears,
He deeds of valour antedates,
His ban an army fears.

ARITHMETIC IN RHYME

Here are some arithmetical problems in rhyme, which we shall find quite interesting to solve. First of all, who can do this?

Twenty-seven with three nines
You and I can score,
Anyone on other lines
Can extend them more;
Who can write them to be seen
Equal only to sixteen?

A man being asked the ages of himself and his wife when they were married, replied:

When first the marriage knot was tied
Between my wife and me,
My age as oft repeated hers
As three times three does three;
But when ten years and half ten years
We man and wife had been,
Her age came then as near to mine
As eight does to sixteen;
What age was hers, what age was mine
When we were wed, from this divine.

This is a little problem that is quite easy when you know just how to do it.

A third of six behind them fix
A third of six before,
Thus make two nines, when all combines
Exactly fifty-four.

A little boy asked his father how old that parent was, to which the father replied:

I was twice as old as you are
The day that you were born;
You will be just what I was then
When fourteen years are gone.

What were the ages of the father and son?

RIDDLES IN RHYME

Some very ingenious riddles can be asked in rhyme. Here is one:

With letters three indite my name,
Add one to show what I became,
Or try to tell what brought me fame.

The name is that of a well-known literary man.

Here is another conundrum in verse:

Often talked of, never seen,
Ever coming, never been,
Daily looked for, never here,
Still approaching in the rear.
Thousands for my presence wait,
But, by the decree of fate,
Though expected to appear,
They will never see me here.

What is the solution of this?

SOME CHARADES

It is quite an active mental exercise as well as a pleasant amusement either to write a charade in the form of a rhyme or to solve one. In a charade, as we of course know, a word is taken, each syllable of which has an independent meaning, as in the name Campbell. Here are one or two clever charades:

My first is a circle, my second a cross;
If you meet with my whole, look out for a toss.

My first makes company,
My second shuns company,
My third assembles company,
My whole puzzles company.
My first I hope you are,
My second I see you are,
My whole I know you are.

THE SOLUTIONS TO THESE RHYMES AND PUZZLES WILL BE FOUND ON PAGE 4500 OF THIS BOOK.

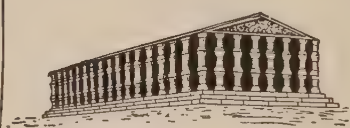
WHAT TO DO WITH SPOOLS AND BRICKS

IF we save all the empty thread spools and put them into the playbox, we can spend many happy hours playing with the spools and a box of toy bricks. When not in use, we can keep the spools threaded on to a piece of string to prevent them from rolling into out-of-the-way corners. One of the most interesting things we shall be able to make is a little bridge to span a river.

First we must pick out ten fairly long spools to form the supports of the bridge. These spools we must soak in hot water to loosen the paper labels, which can then be scraped off. We place the spools on end in five couples at equal distances apart and join them up with long bricks, or a strip of card, cut the width of the two spools, which is long enough to span the river and rest on the banks. We can build up bricks to support the ends. The card can be nailed to the spools with tin-tacks near the edges, and if we care to make parapets, two strips of card can be bent at right angles and the bent part glued down over the heads of the nails. This little bridge will be fairly substantial, and real water can pass under it, while over the top we can run a toy motor-car or train.

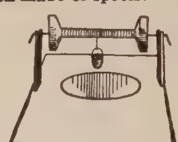
A bridge of bricks and spools.

A chariot.



The Parthenon made of spools.

Doll's table.



A well.

If we place four long empty spools on the table, two and two, on their sides, they suggest to us the possibility of making a pair of roller skates. A piece of thick wire must be bent round each end of the narrow central part of a reel, and a little sheet of tin, such as we can get from a preserved fruit or meat tin, should be shaped like the sole of a boot and attached in place by the wire coming up from the reels. Black tapes can be used for straps, and drawn under the tin near the wheels. A small glass dish, such as that in which potted meat is sometimes sold, might be tied on to the tin, filled with flowers and placed on the table, where it will make a novel flower-vase for pansies or other short-stalked flowers.

Another little toy, a miniature chariot, can be made with two long spools, as long as we can get, placed on their sides, one in front of the other. On the central part of the spool we lay a flat piece of wood from the box of bricks, or a piece of cardboard. This we can secure to the centre of the spools with twine. A sloped piece of card is then glued round the front of this, as shown in the picture. We can then make the chariot bright by covering it with silver paper. This serves as a very pretty holder for a glass of flowers. In a similar way, a truck, such as railway porters use, can be made by leaving out the card at the front, and adding parts of wooden skewers for handles.

To make the third toy shown in the picture, take three long, narrow spools and place them one on top of the other in piles, arranged eight in a row in front, eight at some distance behind in line with the others, and the intervening space along each side filled with fifteen piles. What we are making is a model of the Parthenon at Athens. Having built up the columns, we place a row of bricks along the summits, place triangular pieces of card at each end to support two large pieces of card which will serve for the roof, and we have a rough copy of the Parthenon.

There are plenty of old churches in London and other cities built in this Doric style, which we can also imitate. A church steeple ending in one spool, with a wire or pin weathercock inserted in it, is simple to construct. Another thing we can build with our spools is a tower, and for this we shall want plenty of long, narrow spools. After making a brick foundation, we place a dozen or more spools close together in the form of a circle, and lay a disk of brown paper or card between each circle until seven tiers are built up, using fewer spools as we ascend. If we are skilful enough to place some of the disks a little on one side, we can imitate the tilt of the Leaning Tower of Pisa, shown on page 319.

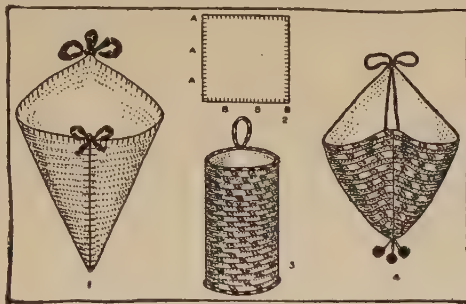
Other spools besides cotton-spools may be available for making small toys. The spools on which wire is wound make nice wheels for a child's go-cart or mail-cart. The body of the cart is made of wire bent in a similar way to that used in making doll's furniture, described on page 1733. If a piece of white paper be pasted over one end of a short spool, we have a table for the doll's house.

We can make quite an elaborate toy in the following way. A wooden skewer, cut to a suitable size, is wedged into the central hole of a long spool, and is supported at the two ends in grooves of two upright pieces of wood which are glued to a piece of card with a circular hole in the middle. Two long, stout pins are hammered into the ends of this improvized wheel, and bent at right angles to form two handles used in winding and unwinding a thread rope, to which a little bucket is attached. A thimble, with a piece of wire encircling the rim and forming a handle, does nicely for this. Twine or coarse sewing thread will do for the rope, which should now easily draw up bucketfuls of water out of a tumbler over which the little well-head may be placed

HOW TO MAKE A HAIR-RECEIVER

THERE are many ways of making a hair-receiver; we are going to describe three very pretty patterns which are quite easy and inexpensive to make.

That shown in picture 1 is made from a piece of canvas about six inches square. The edges of the canvas are worked with buttonhole stitch in silk or bound with a pretty-colored ribbon. When we have done this, we must sew together neatly the two sides marked A and B in picture 2, tie a dainty bow of orange or pale blue ribbon on it, and the article is complete. If we like we can work a daisy or some other flower on the top and the two sides. Another kind is made from an old cocoa-tin, covered with silk and crochet work.



Three ways of making a hair-receiver.

We should choose a small can, line it all over with silk, and then cover the outside with crochet work. Strawberry or a coral shade of pink gives a pretty effect.

When the tin is lined, we must get some thick silk and crochet a strip large enough to go right round the tin. The pattern of the crochet should be three treble, three chain, three treble, three chain, and so on. We learned how to crochet on page 1364. Then carefully sew it on to the lining, and edge top and bottom with a fancy cord, making a loop at the top by which to hang it up. Of course, the silk and cord must match the lining.

The finished hair-receiver is shown in picture 3. The third, and perhaps the prettiest, pattern of all is this. Crochet a square in white cotton, and line it with very soft pale pink silk, so that one side is crochet and the other silk. Then crochet two pieces of chain stitch long enough to go across from corner to corner, and sew it on. Then sew three pink balls on to the end of three tiny crochet chains, and fasten the other end of the chains to the bottom of the bag. If they are too big, the effect will be spoiled. The little crochet bow, shown in the last picture on this page, is fastened on by the crochet needle, and the crochet chain extended, taken through the front of the bag, and fastened off by the bow at the top. This is to act as a support to the crochet, which, being so soft, would otherwise fall down.

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF SEPTEMBER

IF the seeds of the globe beet were sown in good time in the spring, the crop should be ready to dig and store. It is necessary to lift these vegetables very carefully; they must not be pricked or cut, or the skin in any way broken, or even the tap root broken off short, or the juices will escape, and the vegetable deteriorate. The long beet is a somewhat later crop.

As soon as we have cleared away a crop, we may dig over the ground deeply, so as to let sun and air do their wholesome, sweetening, and purifying work.

Another gardening operation that will need attention is the earthing up of the celery. Some rows may already have been done, but the later rows will now be ready. The best time to choose for the work is while the soil is still slightly moist from rain; if the weather is dry, however, a thorough watering should previously be given, pouring the water close down beside the plants.

The scarlet runner beans will probably be producing more pods than are needed for present use, and, rather than leave them to exhaust the plant, they may be picked and preserved for winter use. This is a very simple matter, and all we need is a jar. We put a layer of beans and then a layer of salt, alternately, until the jar is full, and then fasten the cover down firmly. Before use, the beans must be well soaked in water to extract the salt from them.

There may still be potatoes to lift, and not only to lift, but to store. For potatoes, for carrots, and also for beet, as convenient a method as any is to make a *clamp*, so long as it is well made and capable of keeping out the winter's frost. We place our roots, or our potatoes, under straw and soil. First of all we dig a round pit in the ground, say, some six inches deep, and line the bottom and sides with a good layer of dry, clean straw. Next we make a heap of our potatoes or our roots of beet, and, later on, of carrots. Over these we must place a thick covering of straw, and on the top of all a layer of soil about seven inches thick. When the soil is in place, the back of the spade should be used to beat it down tight and close, and probably that seven inches will be greatly reduced and more soil will need to be added to it.

But we should not quite cover the top; a hole or two should be left for a time, because the moisture in the vegetables and soil must have an escape. When the real wintry weather sets in, we can put some extra straw into these ventilation holes. We must not forget, when storing our potatoes, to look them well over, and to throw out any that show signs of disease. Potatoes once lifted from the ground should be kept as dry as possible, and should not be exposed to the light longer than is necessary.

If beet, parsnips, and other *root* crops are not stored in clamps, but are kept in some cellar or outhouse, some sand should be

placed between them to prevent their drying and shriveling. It is important to remember that the frost must never be allowed to reach them.

At this season of the year there will be an abundance of rubbish in the garden, old pea-tops, weeds, cabbage-stalks, and much else. If we are allowed a bonfire, this is not only the best means of getting rid of the rubbish but also of turning it to good account, for the ashes of vegetable matter contain many things that are necessary for living plants to have; so that all the ashes left should be dug into the soil.

It is often a little difficult to decide if the apples and pears should be gathered or hung a little longer. Much depends, of course, upon the variety, and a good test is to cut one of the apples in halves and examine the pips. Are these quite ripe and black? If not, the fruit has not fully matured; but if they are quite colored a uniform black, and the fruit severs easily from the branch, then we may take it for granted that it is ready for storing.

The great point in fruit-gathering is to see that it is not bruised. Wind-falls should be kept separate, and should never be allowed to lie longer than can be helped on cold, dew-laden soil.

Of course, they are for immediate use, but they are much better if carefully treated, gathered up each morning and laid out separately. Steps are very useful for gathering the low fruit on the outside of a tree where it is difficult to reach from the ladder.

It is quite time to prepare the ground by digging, not forgetting to add some stable manure, if we contemplate planting fresh fruit-trees next month or the month after. It is a good plan thus to prepare the soil in readiness some little time in advance of planting, as this gives it the chance to settle.

MAKING A CHEMICAL WEATHER-GLASS

WE may have seen a curious-looking weather-glass in the form of a round tube containing a liquid which becomes clear or cloudy, or flaky or spotted, so that we can tell what sort of weather we are going to have. Some weather-glasses are really very good, and are very easy to make. First we require a glass tube ten inches long and three-fourths of an inch in diameter.

We should purchase at any chemical instrument dealer's shop a test tube of this size, for which we may have to pay only a few cents. We can fasten it to a flat piece of wood if we wish to hang it on the wall, or, if we wish it to stand, we can make a round base with a round hole in the middle, so that the tube can go into it about one inch.

The method of making the wood frame or base is not important, and is only for the purpose of steadying the tube. When we have done this, we must have a prescription made up at the druggist's. Here it is:

Camphor, two drams.
Potassium nitrate, half a dram.
Ammonium chloride, half a dram.
Absolute alcohol, two ounces.
Water, two ounces.

The price of this mixture will be somewhere between fifteen and thirty cents. If the solid ingredients do not dissolve readily, they may be assisted by shaking the bottle, and even by putting the bottle in a little warm water, taking care, however, that more water is not allowed to get into the bottle. When the mixture is properly dissolved, it should be poured into the weather-glass tube that we have already prepared.

Then we put a cork in the top of the tube, to keep out any dust that might get in. The weather-glass is now ready for its work, and may be hung up or placed wherever we wish to have it; but it is best placed exposed to the north and in a shady place, where it cannot get the direct rays of the sun. The appearance of the liquid will change when the weather is going to change. Here are the indications:

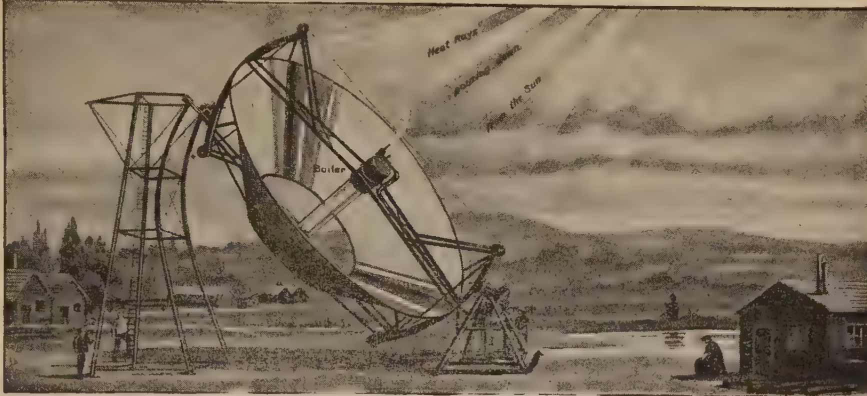
Clear liquid—Bright weather.
Crystals at bottom—Thick air, frost in winter.
Dim liquid—Rain.
Dim liquid with small stars—Thunder.
Large flakes—Heavy air, overcast sky, snow in winter.
Threads in upper part—Windy weather.
Small dots—Damp weather, fog.
Rising flakes which remain high—Wind in upper air.
Small stars in winter on bright, clear, sunny days—Snow in a day or two.

It will be well if we write out on a neat card all the indications, so that anyone examining the weather-glass will have the key to the meaning of the different appearances.

HOW THE FARMER ENLARGED THE FOLD

WE read on page 4293 of a farmer who had a fold made of fifty hurdles that would hold exactly a hundred sheep. Later on, as he had a good deal of pasture land, he decided to increase the number of his animals, so he bought another hundred sheep, and this made it necessary that he should double the size of his fold. In order to do this he bought only two extra hurdles, and the farmer's friend who went to market with him was sure that he had made a mistake, for it seemed impossible to him that the size of a sheep-fold made up of fifty hurdles could be doubled by using only two extra hurdles. But the farmer was quite right. In the first place he had made his fold a long, narrow enclosure, with twenty-four hurdles on each side and one hurdle at each end. Then to double the size of the fold he moved one side farther from the other and placed two hurdles at each end instead of one, by this means exactly doubling the size of the enclosure.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4489.



This picture shows a machine worked by the sun. Hundreds of mirrors are mounted in what looks like a gigantic lamp-shade turned upside down, and the sun's heat-rays are collected by them and reflected on to a large glass tube with a boiler at the end, where the heat turns water into steam.

HOW HEAT WORKS FOR US

CONTINUED FROM 4314

WE know that when things are hot they have power in them which can be used. The most famous case of this—which, according to the story at any rate, set a great man, James Watt, thinking—is the case of the lid of the kettle of boiling water. The heat that is put into the water has the power of making the lid move. Now, if heat applied in the form of steam can make the lid of a kettle move, why should it not start motion in something that is attached to a wheel? The answer to this question is supplied by every engine that is driven by heat all the world over to-day.

On the other hand, just as heat can do work, so work can make heat. One of the old ways of lighting a fire was to rub together two pieces of dry stick, and that produced heat enough to make a spark. In the same way, anyone can prove that heat can be produced by work if he rubs his hand on his coat.

The work of rubbing or striking a match puts heat in it, and when it is hot enough it catches fire. In a word, the kind of motion which we call heat can be turned into ordinary kinds of motion, like that of a wheel or the lid of a kettle; and ordinary mechanical motion, as it is often called, can be turned into the special motion called heat. It is worth while to know the simple way in which this may be stated in scientific language. The Latin word for a mass is *moles*, and from that we get the word *molecule*, which means a little mass. Now, when a thing which we can see—such as a match, or our hand, or a wheel—is in motion, we may call that a case of *molar motion*—the motion of a mass. But heat, which is a case of the motion of the molecules of things, may be called *molecular motion*. So we may say that molar motion may be turned into molecular motion, or molecular motion into molar motion; in other words, work may be turned into heat, or heat may be turned into work.

The importance of understanding this rightly in our thinking is very great indeed. Heat and work sound such very different things. It is true that we can get work out of heat, and heat out of work. There does not appear to be any particular reason why there should be any fixed relation between the amount of heat to be got from a particular amount of work, or the amount of work to be got from a particular amount of

heat. It sounds as if work and heat were two such different things that they could not well be measured against each other. But if we think of heat as molecular motion, and of work as molar motion, then it seems reasonable that one kind of motion should be turned into the other, and also that there must be an absolutely fixed amount of either kind of motion that can possibly be got from the other kind. If that be not so, some motion is being got out of nothing, or some motion is being made into nothing; and we are sure that neither of those things can happen.

What we have just been saying makes the basis of a very great and important science called *thermo-dynamics*. We might translate that "heat-force"; and this great science deals with all the relations that exist between heat, on the one hand, and power, on the other hand. This science bears not only upon the making and working of all machines made by men, but it bears upon the history and the future of the living and eternal machine which we call the universe, and which is made from everlasting to everlasting by God.

A LAW OF SCIENCE THAT WAS PROVED AFTER TWO THOUSAND YEARS

The great law of the conservation of energy has been established in modern times by the study of heat and work. Before the birth of Christ, great thinkers guessed that what we now call the law of the conservation of energy must be true; but the proof of its truth had to wait until the nineteenth century after Christ, and depends upon whether the amount of work we can get from a certain amount of heat, or the amount of heat we can get from a certain amount of work, is absolutely fixed.

Later still, we have begun to see why this must be as it is, because we see that, after all, what seemed to be such a mystery is only a case of changing one kind of motion into another kind of motion, and that is the thing we see and do for ourselves every day.

Less than a hundred years ago, a celebrated Englishman, named Joule, proved, by experiment, that there is a certain amount of work which can be got out of a certain amount of heat; and nowadays we use "J," the first letter of his name, to mean the amount of work which can be got out of a certain known or measured amount of heat. Thus, we take the amount of heat which can raise the temperature of one pound of water at 60 degrees Fahrenheit up to 61 degrees Fahrenheit, and we find that that amount of heat is equal in power to raising 778 pounds through a height of one foot, or one pound through a height of 778 feet. But what the exact figure is matters nothing at all, compared with the great and all-important fact that there is this relation.

HOW HEAT CAN BE CHANGED INTO WORK, AND WORK INTO HEAT

The first law of this part of science is, therefore, that between heat and work there is a constant relation; that either can be transformed into the other. But there follows a second great law which says that though the first law is true, yet heat will only travel from a body that is higher in temperature to one that is lower.

The first law is another form of putting the law of the conservation of energy, but the second law says that, though energy is never lost, yet there are only certain conditions under which we can use it so as to get work done. The energy may be there, but it may not be available, and that is true of all heat wherever it is found, except where it can flow to something that is less hot. For practical use for doing work, it is not sufficient that energy be not lost; we must be able to get at it.

Every machine that is run becomes warm, and that warmth is given away to the air around it. Our bodies, which are living machines, though they are also more, are always losing heat to their surroundings, and, indeed, it is a general rule that other forms of energy, such as the chemical energy in our food, or the chemical energy in the food or fuel of an engine, tend to be turned into heat, and the point is that this heat is scattered and cannot be used again.

THE MACHINE THAT GIVES HEAT WHEN WE WANT IT TO GIVE WORK

First, let us see how this affects the engineer. It means that when he makes and uses a machine from which he wants to get work, only part of the energy which he puts in comes out as work, and much of it comes out as heat. This heat is not only useless, as a rule, but worse than useless, and causes endless trouble in order that it shall not make

the engine so hot that it will not work. Also, the question of cost comes in, because all the fuel has to be paid for, but only a small portion of the power in the fuel is turned into the work which we want to get out of it.

The world, as we know, is at present living upon its supply of coal, and doing so at a tremendous rate, but far less than one-tenth part of the energy contained in that coal, and put there, so to speak, by the sun, is really used by mankind. The rest is frittered away into the air as heat, and simply wasted.

THE GREAT WASTE OF ENERGY THAT GOES ON IN THE WORLD

An open fire is, perhaps, the most wasteful of all ways of transforming energy, but, at any rate, the heat produced is of some use for the time. Now, if we look at any of the engines which are at work all over the earth, we find that they can all be studied from this point of view. How much of the energy put into them comes out as work, and how much is wasted as heat? We are not far wrong if we say that one-tenth of the energy put in is used, and nine-tenths are wasted.

Anyone who could invent a machine that would turn into work all the energy put into it, or half, or one-third, or one-quarter, would soon be the richest man in the world. So important is this question that there are, of course, everywhere men working at it. The word they use is "efficiency," and their business is to try to increase, even perhaps by only one per cent, or less, the efficiency of the engines at which they are working—that is to say, the proportion of work they do compared with the amount of heat they produce which is useless.

THE SECRET OF POWER IN OUR MUSCLES WHICH NO MAN CAN DISCOVER

The most efficient engine in the world is a living muscle, but the secret of its efficiency has yet to be discovered. Even a muscle, however, does not turn into work all, or even half, of the energy supplied to it; the rest is turned into heat, though this heat has to be looked at very differently from the heat produced, say, in the engine of a motor-car, for it keeps our bodies warm, and maintains them at the temperature at which we can best live. Both on the score, then, of its pure efficiency in terms of work, and its usefulness in regard to the heat produced, a muscle is immensely superior to any machine ever made, and that is to say nothing of its powers of lasting and repairing itself.

But this question of the production of heat by machines, though it is of deep practical importance to mankind, is of even greater importance in another way. It is not only machines that tend to turn useful energy into heat that cannot be used *again*—even if it be useful at the time—in the sense that the mill-wheel cannot run with the water that has passed. All the changes of energy that we can discover seem to follow the same course.

Nearly all chemical changes produce heat, and that heat is scattered and lost. Every kind of motion, besides the motion of machines, is in some degree turned into heat by friction, and that heat is scattered and lost. And therefore we have to learn a new idea which goes along with the great truth of the conservation of energy, and must always be remembered together with it—this is, that though no energy is ever lost to the world, so to speak, it may very easily be lost to us.

THE HEAT FLOWING FROM THE SUN AND FOR EVER PRODUCING WORK

We may classify all sorts of energy, indeed, according to their usefulness for us, and then we discover that it is the general tendency for energy to be *degraded*—to fall in the course of its changes from a more useful to a less useful class. The general end of these changes tends to be that the energy is degraded to the lowest class of all—that of scattered heat, which we cannot use at all. An instance of energy in the highest class is furnished by the energy of the sun—a body which is intensely hotter than its surroundings. The flow of heat of this hot body to less hot bodies produces work, just as the downward flow of water from a height may do work.

We have only to consider for a moment what happens to the sun's radiations to see that, in the course of every change which the power of them undergoes in our bodies or elsewhere, a certain amount is frittered away as heat, and so this energy of the highest class is rapidly degraded to the lowest. We do not suffer, and we are not alarmed, and the reason is that there is always

a fresh supply of energy coming from the sun. But that supply, though it will last a very long time, cannot be endless. Now that we know what *the degradation of energy* means, we must learn the use of another word, first employed by Lord Kelvin, of whose work we read elsewhere in this book. He spoke of what has ever since been known as *the dissipation of energy*. When we speak of a foolish man who dissipates his fortune, we mean that all his money is spent and scattered, and that is what is meant by the dissipation of energy.

WHY WE CAN NEVER GET A REALLY PERFECT MACHINE

Now, we read on page 3888 about the results which would have to follow if the law of gravitation were unopposed, so that by its action the whole of the matter in the universe would all be gathered together into one mighty heap. Just in the same way, the argument now is that all the energy in the universe tends to be steadily degraded and dissipated, taking the form of scattered heat, incapable of doing anything.

If we had a perfect machine we should be able to work it backwards as well as forwards, turning heat into work and work into heat, and never losing anything. There is no such machine, and, according to Lord Kelvin, not even the universe itself is a perfect machine in this sense of the word.

That is to say, it has a bias towards working in one direction, which is the direction of the dissipation and degradation of energy. If this goes on, as it appears to do, the consequences must be tremendous, and we find ourselves led to the same kind of result as we supposed when we imagined that gravitation had nothing to oppose it.

THE RUNNING DOWN OF THE CLOCK OF THE UNIVERSE

If the idea of the dissipation of energy is really true, and the whole truth, it means that the universe must be traveling towards a state of things in which nothing happens—a state which we might describe as the death of the universe. Its matter and energy would still be there, but they would have lost their power of doing anything. Nothing would happen, there would be no life and no motion of any kind. This idea makes us think of the universe as a great clock, made, wound up, and set going. It may run for a very long time, but, like other clocks, it must run down at last. Here we are faced again with the idea of a beginning and an end to the history of the universe. Thus, if we take our solar system as a case in point, we see that, at present, just because the heat-level is higher in the sun than in the planets, heat flows from the sun to the planets, and so on our earth life is possible.

But the spreading out and leveling of the heat in the solar system must some day come to an end, and with it must come to an end not only life, but all the other processes in the solar system which depend upon this difference of heat-level.

The prospect of the theory of the dissipation of energy is that the solar system and the whole universe must, at last, reach a stage in which all the other forms of energy have been degraded and dissipated into heat, and that heat will be spread equally through all the matter of the universe. That would be the end of its history.

THE WINDING UP OF THE CLOCK OF THE UNIVERSE

We may slightly change the words of a great student who summed up the case, as it was then thought, at the end of the nineteenth century, and who spoke as follows of the doctrine of the dissipation of energy: This remarkable property of all natural processes seems to lead us to the idea of a definite beginning and to shadow forth a possible end—the interval, which contains the life or history of Nature, being occupied with the slow but inevitable running down or degradation of the great store of energy, from an active to an inactive or unavailable condition.

But, as we study this subject now, we are beginning to see farther and deeper than all but one of the wisest saw in the nineteenth century.

Herbert Spencer stood alone among the great thinkers of the nineteenth century in declining to accept the doctrine of the dissipation of energy. He saw too deeply into the nature of things to believe in the old ideas of beginning and ending, and he saw that the argument for the dissipation of energy was not complete. He declared

HOW HEAT MAKES THINGS EXPAND

In these two pictures we see how heat affects a gas. If a balloon be half filled with air, as in the first picture and placed in front of a fire, the air, as it gets hot, expands and fills the balloon, which will at last burst.

This picture illustrates the effect of heat upon solid bodies. When a railway line is laid down, space is always left between the lengths of rail, as indicated by the arrows, to allow for their expansion by heat.

If we place a liquid like methylated spirit in a narrow-necked bottle and stand it in ice, the liquid will shrink from the point S, at which it stood, to V. Now if the bottle be placed in hot water, the liquid will rise to A.

that there must be other processes going on, none the less real, though not so easy to see, which were, so to speak, winding up the clock while other processes, which we could see, were tending to run it down.

Steadily, for some years, the idea of this dissipation of energy, as *completely* true, has been losing credit among those who study these matters, and the deep insight and rare wisdom of Herbert Spencer are beginning to be justified in this respect, as in many another, by the discovery of processes and possibilities in the universe which lead us to believe that it is, indeed, a perfect, an eternal machine, besides being very much more.

The more deeply we study, the more convinced we are that the real answer to this question is the same as the answer lately discovered to the question about the results of gravitation. There we find that what seems to be a process all in one direction, which must have a beginning and an end, is only half the truth; and when we learn the other half, as, for instance, in the study of what we call radiation pressure, we see reason to believe that the universe can go on and on for ever.

If the hand be placed round a glass bulb, the heat of the hand will expand the air in the bulb; but when the hand is slightly removed, the air cools and shrinks a little so that some water is forced up the tube. If the hand be quite withdrawn and the tube taken from the bowl, the air in the bulb cools and shrinks, and the water in the tube is forced up by the outside air.

Just in the same way we are beginning to discover the processes which act in the other direction, and which will lead us to the belief which we have already stated, the belief of the wisest of all ages, that the universe is from everlasting to everlasting.

We have now learned enough to show us how extremely important is the question of temperature, and by temperature we understand heat-level. It is difference of temperature that gives heat the power of doing work. That difference of temperature means that the heat will flow, and in flowing can be made to do things. Now, what exactly is difference of temperature? Indeed, what is temperature at all? Our first inclination will be to answer that the temperature of a thing is the amount of heat in it, but we shall find that that is not true. It is true that if we take a given amount of a given thing, and add heat to it, it will become hotter; its temperature will rise, and that rise of temperature means in that case that there is more heat in the thing.

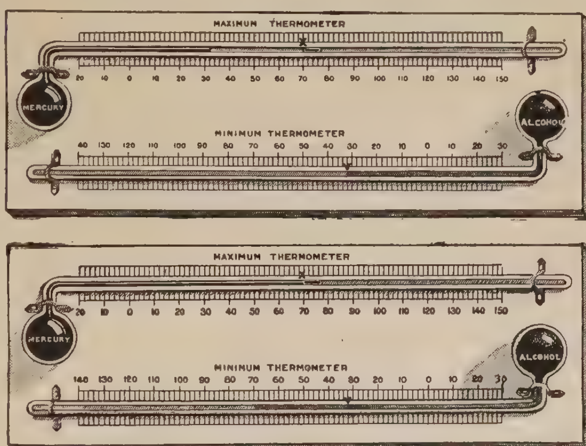
But even if we take a given thing, such as water, we find that to raise a given quantity of it one degree in temperature, at some level in the temperature scale, requires more heat or less heat than to raise its temperature one degree when it is much colder or much hotter to start with than it was in the first case. Then, again, there is much more heat in a large quantity of cool water than there is in a very little water that is hotter, so that again we cannot say that temperature is the amount of heat in a thing. We must think of temperature as if it were like the level of water. Even a little water at a great height, falling into a large lake, has a something about it which the lake has not. For instance, it will turn a wheel. Now, temperature is like the level of water, and has no more to do with the amount of heat, as such, than the mere bulk of water has to do with its power. There is something in the slender waterfall that there is not in the lake below, and that something corresponds to the height from which it falls, and enables it to do work. So the temperature of a thing may be compared to the height from which the water falls in the other case; and, other things being equal, the higher the temperature of a thing, the greater is the work that the thing can be made to do as it cools.

The word *thermometer* really means heat-measurer, but we are now ready to learn that, though the thermometer is called a heat-measurer, it is not a heat-measurer, but a measurer of heat-level. Think of the water falling into the lake, and we see the difference. The thermometer corresponds to an instrument that should tell us the height from which the water fell, but that told us nothing

about the amount of water that fell. The thermometer tells us nothing about the amount of heat, but only about heat-level.

The first thermometer was made by Galileo, little more than three hundred years ago. It was an air thermometer—a glass tube ending in a bulb. This tube was heated and then turned upside down in a vessel of water, as shown in the picture on page 4394. As the air inside the bulb, which had been heated, began to cool, the water ran up the tube.

The air inside the bulb would occupy more space if it were hot, and less if it were cold, and the water would run up the tube in more or less degree accordingly. So by the height of the water something could be told about the temperature of the air. Now, directly we consider this we shall see, from what we have already learned, that this instrument was a barometer as well as a thermometer, for the water was partly pushed up by the air.



These pictures show maximum and minimum thermometers, which register highest and lowest temperatures. In the upper picture the minimum thermometer is at 32°, the lowest point reached overnight. The alcohol carried the indicator, v, to this point, and left it there when the temperature rose, as in the lower picture. In the maximum thermometer of the lower picture, the mercury is at the supposed highest temperature of a day. It has pushed the indicator, x, to 70°, and when it shrinks to a lower temperature, as in the upper picture, the indicator is left at 70°. The indicators mark the highest and lowest temperatures reached.

In this, its first form, the instrument was not, therefore, very useful, for no one could tell to what extent it was measuring the pressure and to what extent it was measuring the temperature of the air. What was required was to close the tube altogether after heating it, so that the atmospheric pressure should have no effect upon what happened inside it. This was not done until half a century after Galileo's first work. At this time, instead of water, alcohol was used. In 1670 mercury was first used.

If we wish to make an ordinary thermometer, then, we take a fine tube with a bulb at one end, and fill the bulb and part of the tube with mercury. Then we boil the mercury. This means that part of it forms a vapor, which travels up the tube and pushes away the air in front of it. While this is going on, we close the end of the tube, and allow the mercury to cool. A practically empty space is then left above the level of the mercury in the tube, and if the mercury has any reason to expand or to contract, it will be able to do so freely in either direction.

The hotter mercury is, the more it swells, and the more space it takes up; the colder it is, the smaller the space taken up. Therefore, the level of the mercury in the tube tells us how hot it is. The higher it is, the hotter it is; and the lower it is, the colder it is. We shall notice that this is just the opposite of Galileo's air thermometer, for in that the colder the air inside, the higher stood the column of water. The really difficult and important part of making a thermometer is yet to come, because we have to find what height in the mercury of the tube corresponds to a certain temperature. It would be no use having a thermometer that was wrongly marked, especially if it is wanted to measure differences in temperature that are very small.

Notably does this apply to the thermometers used by doctors in order to find out how hot the blood of their patients is, for in such a case the differences in temperature are quite small, but may have very large meanings when the doctors are led astray. Nowadays, therefore, great skill and trouble are employed in testing all except the very cheapest thermometers.

THE NEXT PART OF THIS IS ON PAGE 4501.

SPANISH AND FRENCH INVADERS OF MEXICO

There is scarcely another story in all history so romantic as that of the Spanish conquest of Mexico in the sixteenth century. With an army of 400 European soldiers and 16 horses, both of which numbers were afterwards slightly increased, Cortes, the Spanish commander, set out to conquer a mighty empire. He had to meet a nation in arms; but when disaster seemed certain, Cortes, by ability and skill, routed the Mexican army at the famous battle of Otumba, and later subdued the whole country for his emperor.

More than three centuries after the conquest of Mexico, the country was again invaded. The Emperor Napoleon III. of France, making the unjust treatment of foreigners in Mexico an excuse, declared war in 1862, and forced an emperor of his own choosing, the Archduke Maximilian of Austria, upon the country. In 1867, however, the French troops withdrew from Mexico, and, some time after, Maximilian was shot by the republican party. Here we see the French army, under Marshal Bazaine, entering the city of Mexico.

Popocatepetl, or "Smoking Mountain," the great volcano of Mexico, which is nearly 18,000 ft. high.

MEXICO AND CENTRAL AMERICA

CONTINUED FROM 4308

ARMS OF MEXICO

SOUTH of the United States, but still a part of the continent of North America, lie Mexico and Central America, seven states in all, besides a bit of territory which is a part of the British Empire. Below them are the many countries of South America, of which you may learn elsewhere. All except Salvador are washed both by the Pacific and the Gulf of Mexico. That tiny country lies on the Pacific alone.

Let us look carefully at the shape of the gulf into which the Father of Waters, the Mississippi, and the Great River of the North, the Rio Grande del Norte, pour the southern drainage of North America. The two peninsulas of Yucatan, which is a part of Mexico, and Florida shut it in like doors, and Cuba lies between them, like a sentinel in the way.

Let us notice, too, the way in which the vast bulk of North America tapers through Mexico to Central America. Notice that there are four narrow isthmuses, with bulging masses of land between them. The most important of the four are Tehuantepec, one hundred and twenty-five miles across, and Panama, less than fifty miles across. Then let us think of the mighty mountain chain stretching, under different names, for thousands of miles from Alaska in the far north, to the extreme tip of the pear-shaped southern continent. There are many volcanoes in this long chain, especially about the middle of it, in Mexico and Central America. At Panama the great heights sink to about 3,000 feet, and the pass, or saddle, between these low mountains is less than 300 feet high. Through it the Panama Canal has been cut. To the west of the mountains lies the vast expanse of the Pacific Ocean, which is now joined to the eastern waters by the great canal.

Four hundred years ago no one could have given this simple description of the position of Mexico and Central America. Columbus died fully believing that the land he discovered was part of Asia. By degrees, his successors, cruising about the low-lying shores of the gulf and the sea, caught glimpses of the ocean beyond. They sought, ever in vain, to find a way for their ships through the narrow neck of land to that ocean, and the truth came to them. They were not on the fringe of Asia, but on a great continent which lay between them and their desires. How one envies them the first sight of the Pacific Ocean from Panama!

Copyright, 1918, by M. Perry Mills.

THE GOLDEN LAND THAT LAY BEYOND THE WESTERN SEAS

Wonderful rumors, spread by these adventurous spirits, soon reached Cuba, one of the first islands settled by the Spaniards. There were stories of massive temples and great stone idols; of large towns with thousands of busy workers; of people with rich clothes and great possessions in gold and silver and jewels.

All these, they said, were to be found inland from the shores of the gulf. Daring deeds were daily occurrences in the sixteenth century, but one of the most romantic and desperate expeditions ever planned and carried out was that of the brilliant Spanish commander, Cortes. He started out to test the truth of these rumors, and to annex whatever he might find for Charles the Fifth, who was also king of Spain, as well as emperor.

The stories we have of his forces do not all agree. We know that he set out from Cuba in ten or eleven ships in November, 1518, and that he had several hundred Spaniards with him. Some say that there were only 400, and some say there were nearly twice as many. He had a few horses, and a few cannon. Truly, it was a small force to conquer an empire.

Cortes did not land until March of the next year. The ships, the horsemen, the cannon made the natives think that the white men were gods. The town of Vera Cruz (True Cross) was founded.

THE WONDERS OF THE LAND TO WHICH CORTES LED HIS MEN

The story of a great empire inland made Cortes determine to take possession of its riches. He burned all his ships except one so that the men could not think of deserting him. First he conquered a ruler near by and made an ally of him. Then with his few white men, and many more natives, he set out toward the city of Tenochtitlan, which we now call Mexico.

The way was hard, but the leader was determined, and brushed aside all difficulties. On and on the party toiled from the hot, unhealthy land by the sea, with its tangle of tropical vegetation, up the rugged country which leads by high terrace steps to the great plateau of Mexico, 7,000 feet and more above the level of the sea.

Montezuma II, the ruler of this fair country belonging to the Aztec tribe of Indians, had more than once sent presents and messages to Cortes, begging him to go away. But Cortes went steadily on till he reached the city of Tenochtitlan on the great lakes that lay in the midst of the plateau.

THE TERROR OF THE AZTECS WHEN THE WHITE MEN CAME

Just as the Indians on the coast, the Aztecs were terrified at the pale faces of the Spaniards, at the horses and guns, none of which they had seen before. They seem almost to have believed that Cortes was the white war-god of their legends come back as he had promised centuries before, for the guns appeared to them to flash lightning, and the horses to travel like the wind. General Lewis Wallace's book, "The Fair God," tells the story.

It was not long before Cortes got Montezuma entirely into his power. It seemed as if all were about to be peaceably arranged for the transfer of the country and its government. Just then an Aztec general attacked some men whom Cortes had left at Vera Cruz and killed some of them. This showed that the Spaniards were not gods, and the people grew restless. Cortes had to return for a time to Vera Cruz, for a jealous official in Cuba had sent an army to punish Cortes for disobedience. Cortes defeated the army and enlisted the soldiers in his own army. While he was gone the people rebelled against Montezuma and the Spaniards. Cortes returned only just in time to save his forces from utter destruction.

Montezuma, a prisoner, was persuaded by the Spaniards to speak to his subjects, and urge them not to attack the strangers. An impressive sight he must have looked standing on the flat roof of the palace, dressed in his blue and white mantle, his blazing jewels, fine crown, and golden sandals dazzling in the sun. But the furious people, refusing to listen longer, flung arrows and stones in a great tumult. Montezuma—their king—was fatally wounded during this encounter. The day after his death, when things looked black indeed for the Spaniards, Cortes cut his way out of the capital in the darkness. This was known as the "sad night." Men and horses perished on the narrow path by the waters of the canal and lake, and, when the remnant gathered together in the country beyond, Cortes wept tears of despair.

But the genius of the leader shone only the brighter for this check. Somehow he managed to rally his forces, and within a week he utterly defeated the brave Aztecs, who came out to withstand him. They fled in confusion, more than ever convinced that he must be a god, and not a mere man. This was July 7, 1520. The next year, by means of help from neighboring tribes, and by unheard-of efforts in organizing an army and arranging for its supplies, the beautiful plateau of Mexico, with its ruined capital, Tenochtitlan, fell under the power of Cortes. When the town rose again by the lake, it was as the City of Mexico.

The country, for a while, was put under military rule, and became part of the huge dominions which so oppressed the weary emperor, Charles the Fifth. Cortes was not content with these successes. He made many explorations in Central America, always hoping to find a way through to the Pacific.

More colonies for Spain were founded, in Yucatan and Honduras, and in other parts of the land, whose secrets were revealed by the energy of the great commander and his officers. Cortes even pushed up the long, narrow Gulf of California, and before long the Spaniards had also found their way far beyond the plateau of Mexico in all directions. Cortes himself was badly treated by Charles the Fifth, and died in Spain alone and almost forgotten.

The history of the peoples whom the Spaniards found in Mexico and Central America has not yet been fully unraveled. Scholars are still at work studying the wonderful ruins of temples that are discovered from time to time, the carvings on great stone idols and altars, and the picture writing on various relics. Some of these we can see for ourselves in museums, and interesting it is indeed to trace resemblances in them to the work of other countries, such as Egypt and Babylonia and China.

Mexico and Central America, the link that joins two great continents.

THE MYSTERY OF THE FIRST PEOPLE WHO SETTLED IN AMERICA

Where the first people came from to settle in America, we know not, but the remains found on the soil show that, through the long centuries before the vast lands were discovered by Europeans, different races of people had lived and died on them for generation after generation. Sometimes they destroyed the works of those who went before them; sometimes they grafted their own works upon those of their predecessors.

The first people around the City of Mexico that we know anything about were the Toltecs, who seem to have ruled about 300 years. It was about 1064 they were defeated and driven south by the Chichimacs, who built cities and lived in them. Next come seven tribes of the Nahua stock. The Aztecs were one of these and finally gained the power over the others.

Further south in Yucatan, Honduras and Guatemala, and other states, the Mayas lived. They were great builders, and the ruins of some of their houses can be found to-day. They had a written language and by good luck some of their books yet remain. When Cortes went to Honduras, he passed, all unknowingly, a wonderful palace of the Mayas, hidden by the thick growth of trees and shrubs.

The civilization of the Aztecs was remarkable in many ways. They were not as good builders as the Mayas, but some of their palaces and temples were very large. They did not know iron, but their workmen did wonderful work in gold, silver, copper and tin. They had a system of picture writing, and had large schools. They had learned the use of cotton and wove cloth of it. Their religion demanded human sacrifices.

THE GREAT ZEAL OF THE SPANIARDS TO CONVERT THE HEATHEN AZTECS

As we know, the Spaniards classed the natives they found in the New World all together under the mistaken name of Indians. Now, the civilization and conversion to the Christian faith of these so-called Indians was one of the chief objects of the Spanish conquerors. Bands of devoted missionaries went out from Europe to the new possessions to teach the natives to give up their wild, roving life and the heathen customs of their religion, such as offering human sacrifices to idols.

Cortes himself did his best to persuade Montezuma to accept Christianity, but the Aztec chief was only puzzled by the new ideas so hastily thrust upon him. Everywhere, in the first zeal of overthrowing heathenism, idols and temples, inscriptions and carvings were cast down, buried, defaced; so that the task of finding out the truth about the past has been made even harder than it might have been. Enough has been saved, however, to enable the wise men to tell us a great deal about them, and their beliefs.

THE SPANISH GOVERNMENT OF NEW SPAIN

Soon after the news of Cortes' discoveries reached Spain, people began to come out, but the actual number of white men in any of the Spanish colonies was never large.

As the years passed on, the native races settled down—after many difficulties—to the new religion and new rulers. The new teaching seemed very strange to the simple-minded Indians, and the priests had much difficulty in explaining the Christian religion to them. They were much hindered by the reckless searchers for gold, many of whom were cruel and selfish and did not regard the rights of the Indians.

Mexico, together with Central America and the West Indies, was called New Spain. It was ruled by a viceroy, who was almost always sent out from Spain. Between the appointment of the first, in 1535, and 1821, when Mexico gained its independence, there were more than sixty of them, and only two or three had been born in Mexico. The priests taught the people agriculture as well as religion.

Many beautiful towns were founded after Spanish models, with Spanish names and fine cathedrals; schools and colleges rose up in them, and Spanish families went out to make new homes in the Far West.

Roads and bridges made travel and trade easier. As agriculture was extended and improved, mining was developed, and the raising of cattle then became an important industry. Great tracts of land were given to favorites, and sometimes a man could ride all day on his own land.

Both Mexico and Central America still offer vast possibilities in all these directions. Round the tropical lowlands, rice, sugar, cocoa, and cotton grow easily. On the rising terraces, coffee, maize, and tobacco find suitable conditions, and wheat-fields lead up to the grassy downs, which make good pasture land for the cattle and the splendid horses, for which the country gradually became famous as the years went by.

THE VAST NATURAL RICHES FOUND IN THE FORESTS AND MINES

The magnificent forests abound with every valuable kind of tree, from the rubber tree to the mahogany. As for the mines, Mexico is rich in various kinds of metal—silver, gold, copper, and lead,

among many others. Sulphur is obtained from the crater of the smoking mountain, Popocatepetl. Another remarkable volcano is Jorullo, thrown up by an earthquake in a single night in 1759, from fertile fields of sugar and indigo.

The Indians did not like to work, and some negro slaves were brought in, but not many, for the climate did not suit them.

In time, many Spaniards intermarried with the natives, particularly in Central America; and so many great men of these countries are descended from the conquered, as well as from the conquerors, and a large mixed nation has grown up, with a certain number of pure-blooded Spaniards at the top of society, and many natives "of no account" at the bottom. New Spain gradually came to include nearly all the country round the Gulf of Mexico, and reached out northward to California, though the outlying districts were very thinly peopled.

Spain ever needed all she could get out of her distant provinces, for her wars at home were constant in the seventeenth and eighteenth centuries. Under some viceroys the taxes were excessive, and the people were oppressed in order to send riches to Spain; but under other viceroys the rule was milder, and sometimes even indulgent.

How Hidalgo began the struggle that ended in Mexico's freedom

As time went on the white men born in Mexico thought it wrong that all the high offices should be held by men born in Spain. They had heard, too, of the American Revolution, and of the French Revolution, and some determined to be free. When Napoleon made his brother Joseph king of Spain, the officers did not know which king to follow. In 1810, Hidalgo, a parish priest, started a rebellion, but it was put down, and the heads of Hidalgo and the other leaders were cut off. Another priest, a pupil of Hidalgo, named Morelos, then raised another rebellion, but he too was captured and executed in 1815.

The sad end of the heroes who tried to set Mexico free

The people who lived in those times no doubt thought Hidalgo and Morelos had failed. We who live a hundred years later know that they succeeded gloriously in awaking their countrymen, and preparing the ground for the great struggle that was coming. To-day they are honored in Mexico, and a state has been named in honor of each of them.

But the idea of independence was not dead. The fighting continued and all began to feel that separation was sure to come. Finally Vicente Guerrero, the chief of the rebels, Iturbide, a Royalist general, and the new viceroy met and agreed that Mexico should be independent under a king from Europe. No one would consent to take the throne, and so Iturbide had himself proclaimed emperor in 1822. The people refused to accept him and the next year he resigned. In 1824 the Republic of Mexico was set up.

Iturbide, who was the son of a Spanish nobleman, had been ordered to live abroad, but some of his friends persuaded him to return to Mexico, saying that the people really wanted him to be emperor. When he reached Mexico he was arrested and shot. In later years the Mexican people came to see that though he had been ambitious, he was really the man who had freed Mexico from Spain, and now he is called "Liberator of Mexico."

A time of war and confusion

The new republic had a hard time. The people had never had the opportunity to learn how to govern themselves, and there was little peace or order. Ambitious men struggled to become the head of the new state, and there was constant fighting. The man who won the presidency seldom could hold his place as long as a year. Some of the rulers called themselves dictators, but their power did not last, either.

The most powerful man in all the period of confusion was Antonio Lopez de Santa Anna, who was sometimes on one side and sometimes on the other, but always for himself. He gained fame by driving out a Spanish army which was trying to bring back Mexico under Spanish rule. In 1833, he became president for the first time, just when the question about Texas was to be met.

It was about that time that troubles began with Texas, on the Gulf of Mexico. No one was at all certain about the boundaries of Texas. Some said it was really a part of the Louisiana Purchase, and so belonged to the United States, but it was generally thought to be a part of Mexico. At the time Mexico began to

fight for her independence only a few white traders, missionaries and hunters lived there. A little later three hundred families went from Mexico to colonize it, and a large number of Americans also settled there on grants of land. More and more Americans came and the rulers of Mexico became frightened and forbade any more to come in. An insurrection against the oppressive Mexican government broke out, which ended in the Texans becoming independent in 1836. Santa Anna was captured and agreed to do all he could to make Texas independent. In spite of this the Mexicans made three attempts to conquer the new republic. Finally, in 1845, the United States listened to the request of Texas to make it a state of the Union.

THE WAR BETWEEN MEXICO AND THE UNITED STATES ABOUT TEXAS

We remember that many people in the United States were against this union, because the laws of Texas allowed slavery; also many people in the United States thought a war with Mexico would follow if Texas were annexed, as Mexico had never given up hope of reconquering the new republic. These opponents were soon seen to be right, and Mexico and the United States were quickly at war.

The Mexican War did not last very long. The American troops were well armed and disciplined, and fought steadily. The Mexicans were brave, too, but they were badly led. During the two years of war twelve different men tried to rule in Mexico. You can see that with such frequent changes in the government, the generals would not know what to do. The Americans were victorious in every battle. Vera Cruz was taken, beautiful Pueblo, with its many-colored tiles glittering in the sun, fell without a blow; even Mexico, the capital, was occupied, after the hill of Chapultepec, so connected with old Mexican history, had been taken after a terrific struggle.

After peace had come to the long-distracted country, there was a short time of quiet, when reforms were beginning to take effect, and then troubles came again. President Juarez saw that the state of the country was so bad that it could not pay its debts at that time. He was not very polite about it, and offended the European nations which held the most of the debts. Three of them sent armed forces to protect their rights, they said. England and Spain soon withdrew their remonstrances, but Napoleon III, wishing for military glory, managed to set up a European prince, Maximilian of Austria, brother of the Emperor Francis Joseph, as emperor of Mexico, to be supported by the arms of France.

His short reign of three years is indeed a tragic story. With his young and charming wife, Maximilian set up a gay court in the beautiful palace, restored and furnished in grand style, on the famous hill of Chapultepec. The National Museum in the city close by holds the heavy silver plate, the great glass coach, and many other gorgeous reminders of the brilliant days that passed like a dream, with dinners and dance, and fêtes under the fine trees and among the wealth of sweet roses. The native President Juarez withdrew on Maximilian's entry to the north of Mexico, and bided his time. Suddenly there came a crash. The United States had been occupied with the war between the North and the South while Napoleon III made his schemes. As soon as it was over, the government hastened to remind France that the countries of Europe had no right to interfere with the nations of the American continent, and that they could not recognize a monarchy in Mexico. Napoleon was afraid to venture on a war with the United States, so he was compelled to withdraw the help in money and soldiers he had promised to Maximilian, to keep him on the throne that he had persuaded him to accept.

AN EMPRESS WHO LOST HER REASON; AN EMPEROR, HIS THRONE

The poor Empress Carlotta rushed off to Europe to try what personal pleading would do with Napoleon and with the Pope, but she could not accomplish anything. The strain and sorrow of it sent her out of her mind, and she never recovered. Maximilian refused to give up the throne or to leave the country. He was taken prisoner and shot.

As the French left the country, and the empire they had created drew to its tragic end, one of the greatest of Mexican rulers was making his way to the front. This was General Porfirio Diaz, who took possession of the capital for the Liberals in 1867. Less than a month later the patient, long-enduring Juarez entered it in solemn state and held the presidency until his death in 1872. Four years after

THE CITIES AND BUILDINGS OF MEXICO

This building which stands on a rocky hill, surrounded by cypress-trees, the site of Montezuma's palace is the palace of Chapultepec, and was formerly the home of Mexico's rulers. It is used as Government offices.

The splendid cathedral in Mexico City was begun in 1573 and completed 84 years later. Its walls alone cost $2,000,000; inside there are twenty separate chapels.

Zacatecas, shown here, is a centre of silver-mining. On the left can be seen the cathedral, with one ruined tower, damaged by cannon-shots in the revolution.

Guanajuato, of which we see a general view in this picture, is a great mining capital, and is situated on both sides of a deep ravine with a mountain stream running through it, that in rainy weather becomes a torrent.

Middle pictures copyright by Underwood & Underwood, N. Y.

the death of Juarez, Santa Anna died, poor, blind, and neglected. Though possessing great bravery and military skill, he had always been turbulent and difficult, and often did his country harm instead of good.

A PRESIDENT WHO HAD MORE POWER THAN A KING

After Juarez's death, Sebastian Lerdo de Tejada served as president, and determined to continue in office a second term, though this was against the law. A revolution broke out, and he was defeated by General Diaz, who was elected president in 1877. At the end of his term a friend was elected, and in 1884 Diaz again became president, and later the law was changed to allow re-election. He continued to serve until 1911, when he was forced to resign. Though called a president he was really a dictator.

Diaz kept order and the wealth of Mexico increased greatly under his rule. Railways and manufacturing were encouraged, new public buildings were constructed, and the harbors were improved. Many men of other nations went to Mexico to develop the riches of the country, and all seemed well with the nation. President Diaz made two great mistakes. He decided everything himself and did not train other men to take the government when he grew too old, and he did not try to have the poor people educated. Though he had much Indian blood in his veins he did not do much for the Indians.

Mexico grew richer, but most of the wealth was held by a very few people. The greater part of the population could neither read nor write, and had no property at all except the clothes they wore. They worked on the land or in the mines, and were nearly all in debt. They could not move to find a better position until the debts were paid, and the wages were so small, that this was often impossible. Sometimes they were cheated by their employers to prevent them from getting free.

REBELLION IS RAISED AGAINST PRESIDENT DIAZ AT LAST

In 1910, a wealthy man, Francisco Madero, who felt that all this was wrong, was a candidate for the presidency. Just before the election he was arrested, and, of course, Diaz was re-elected. When Madero was freed he planned a revolt and soon the north of Mexico was ablaze. The revolution continued to spread, and in 1911, Diaz resigned and went to Europe, where he lived until his death in 1915. Madero went to Mexico City, and when the election was held was chosen president.

When the iron hand of President Diaz was removed disorder broke out. President Madero was not strong enough to govern, and soon there were three or four men with armies all trying to seize the power. In 1913, revolt against Madero broke out in Mexico City under Felix Diaz, a nephew of the old president, and General Reyes. The commander of the army, General Victoriano Huerta, went over to the rebels, and both Madero and the vice-president were murdered.

Soon General Huerta was chosen president, but the United States would not acknowledge him to be the rightful ruler. A revolt against him broke out in the north of Mexico, and there was bitter fighting. Both sides sometimes took the property and even the lives of American citizens living in Mexico, and President Wilson warned them that the United States might have to interfere. In 1914 an American force was landed at Vera Cruz, and General Huerta was forced to resign.

THE UNHAPPY CONDITION OF MEXICO CONTINUES

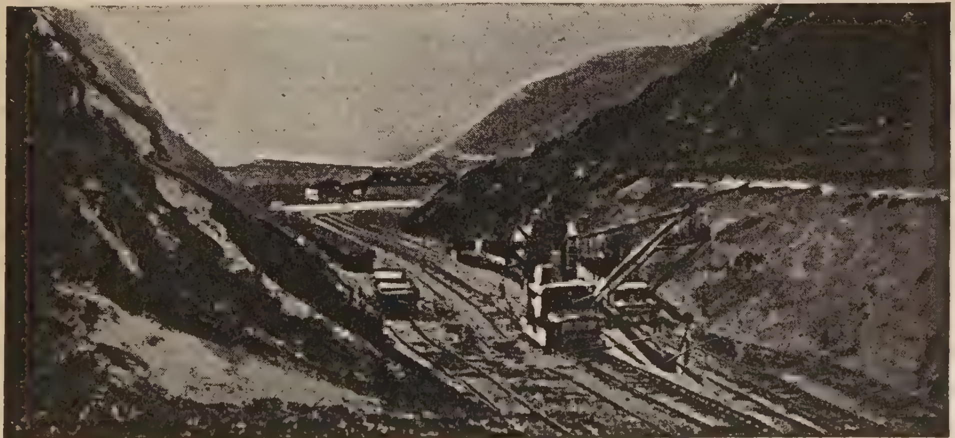
General Venustiano Carranza, the chief of the largest force of revolutionists, now took charge of the government, but he quarreled with General Villa, who was his best soldier, and there was more fighting. For a time four men claimed to control the government. The United States withdrew its ships from Vera Cruz, but later soldiers were sent from the Texas border into the country in unsuccessful pursuit of bandits, and remained for some time. General Carranza finally brought most of the revolutionary bands under partial control but was assassinated in 1920 before the end of his term. At the elections held after his death General Alvaro Obregon, a prominent revolutionary leader, was chosen, and took office at the beginning of 1921. The end of the dreary story has not yet come. Many of the mines are still closed; and foreigners are not willing to risk their lives and property in a country which can not protect them. The great difficulty is that men are not content to decide questions at elections. The party or the man that loses tries to gain his ends

SCENES IN THE SUNNY LAND OF MEXICO

This Mexican railway runs through a prehistoric cutting that has been utilized by the engineers of to-day. The cutting was hewn entirely by hand labor in the old days before Europeans went to Mexico. It is said that the rails are laid on ebony sleepers, and that the ballast used is silver ore from the disused mines of the old Aztecs. The picture shows clearly many different strata of rock and soil laid down ages ago.

Here we see natives of Tehuantepec, who are mostly of Indian blood. The women are making and cooking bread. Many of the customs are primitive.

In this picture a Guatemalan sugar plantation is shown. In the distance we can see the famous Volcano de Agua, with its top among the clouds.



The cutting of the Panama Canal, which divided the New World in two, is one of the most wonderful, if not the most wonderful engineering feat ever attempted. Here we see a very difficult cutting being made through the solid rock at Culebra. Less than a century ago such an undertaking would have been laughed at as a dream.

Second and fourth pictures copyright by Underwood & Underwood, N. Y.

by force. So few people are educated that public opinion in favor of good government is not strong. What is to be the future of Mexico no one can say.

WHAT OF THE TERRITORY SOUTH OF MEXICO?

South of Mexico are six little states and a British colony, which are all together known as Central America. Columbus touched this land in 1502, and soon afterward Spaniards came to conquer the territory. Before the work was done, Cortes had already conquered Mexico, and worried and subdued the Indians. For a time all the country was a part of New Spain, but afterward was independent of the Mexican viceroy, and was governed by the captain general of Guatemala. It was divided into five departments which have since become the states of Guatemala, Honduras, Salvador, Nicaragua and Costa Rica. British Honduras is a part of the British Empire.

The Spanish rulers were generally very bad, and tried to enslave the Indians, who were very stubborn. So few white men came out, that they soon intermarried with the Indians. Most of the population is now mixed white and Indian, or pure Indian, though there is some negro blood in some of the states.

The country declared its independence of Spain in 1821, and was united to Mexico under the Emperor Iturbide. When he fell, the Republic of the United States of Central America was formed, and lasted until 1839, when it fell apart into the states we have mentioned. Since that time there have been many attempts to restore the Union, but one or more states have always objected, and a complete union has never been formed. There has been war nearly all the time, except in Costa Rica. This state has a larger proportion of whites than the others and has been quieter. Either the states have fought one another, or there have been revolutions inside the states.

These five were the Central American states for over eighty years, but in 1904, Panama became the sixth. The isthmus was joined to the Republic of Colombia in 1821, but had been very restless and at times was almost independent. In 1903 it revolted because it feared that Colombia would prevent the digging of the Canal of which you can read in another place. It stretches from Costa Rica to the mainland of South America, but the Canal Zone, through which the Panama Canal runs, divides the country in two.

SOMETHING ABOUT THESE STATES OF CENTRAL AMERICA

Now let us look at the states and see something of them. No one of them is very large, but two are about the size of New York, one the size of Vermont and New Hampshire together, while tiny Salvador is not so large as New Jersey. Panama and Costa Rica cannot agree about their boundaries, and so one cannot say exactly how large either of them is. The population in no one of the states is as great as that of Virginia.

The climate is varied. It is hot in the lowlands near the coast, cool higher up in the hills, and really cold among the mountain tops. There is a rainy season, during which there is a shower nearly every day. A great deal of rain falls in the region, sometimes as much as 200 inches in a year. Much of the soil is very fertile, and almost everything will grow, and some plants yield two crops in a year. Cotton, corn, sugar, rice, tobacco, coffee, and cocoa, besides nearly all the common vegetables, are grown. Bananas, pineapples, guavas and many other fruits grow. There are forests of mahogany, cedar, rosewood, rubber, logwood, and many other valuable trees. Some of our valuable medicines come from Central America, and there are wonderful flowers.

THE BRIGHTLY COLORED BIRDS OF THE TROPICAL FORESTS

The forests contain many birds, many of them with bright plumage. Costa Rica has more species of birds than all Europe. There are many kinds of parrots and macaws, and the curious quetzal, hunted for its tail feathers. In some parts huge vampire bats force the people to keep indoors at night and to protect their animals. There are jaguars, and other large animals of the cat kind, in the forests, besides many queer animals such as the honey-bear, the armadillo, the tapir, and several kinds of wild pigs. Much territory has never been explored by white men.

Central America could support a much larger population than at present. It is one of the richest regions on the earth to-day, and if the states only had settled government many more white men would go there to develop the country. Living is so easy that the natives do not work much, and do not get much from the soil.

THE NEXT STORY OF COUNTRIES IS ON PAGE 4505.

COUNTRY AND TOWN IN CENTRAL AMERICA

Costa Rica has been for many years the most prosperous of the Central American republics. Almost everything will grow in its rich soil, but coffee and bananas are the principal crops. More than 10,000,000 bunches are exported every year. This is a picture of a banana plantation, with the manager's house and the houses of the laborers along the edge. The largest part of the crop is sold to the United States.

This street railway in Panama City was the first to be built in Central America. Many of the streets of the city are so narrow that the car almost blocks them when it passes through. Though Panama is so near to the busy Canal, it still preserves much of the quaint appearance of a city of the Old World.

Pictures copyright by Underwood & Underwood, N. Y.

THE PRINCESS WELCOMES HER DELIVERER

The young prince rode straight up to the gates, which were flung open to receive him. There at the foot of the steps stood the beautiful princess in her bridal robes, with a smile of welcome in her eyes.

THE WATER OF LIFE

CONTINUED FROM 4347

ONCE upon a time there lived a king who had three sons. One day the king fell ill, so ill, indeed, that the court physician despaired of his life.

As the three young men were walking in the garden, they met a little old man, who asked them why they were so sad.

"Our father, the king, is dying," they replied, "and nothing can save him."

"The Water of Life could save him," said the old man, "if you are brave enough to face the dangers that beset the path of those who seek it."

"I will go in search of that water," said the elder brother, "even though it should cost me my life." And the next day he set off.

Before he had gone very far he found himself in a deep valley, and on a bank by the roadside stood an ugly dwarf in a sugar-loaf hat and scarlet cloak.

"Whither away?" asked the dwarf.

"What does that matter to you, imp?" retorted the prince rudely. Whereupon the dwarf gave a loud laugh, and immediately disappeared. But he was so enraged at such uncivil treatment that he caused a spell to be cast over the valley, and the prince, as he rode forward, found the mountains slowly closing in round about him, until he could not move a single step either forward or backward.

At the palace the two younger brothers were anxiously awaiting the prince's return, fearing some ill, when the sick king became rapidly worse.

"I will tarry no longer," said the second brother. "At sunrise I, too, will go in search of this wonderful water."

The young man was brave, and all went well until he came to the valley.

"Whither away?" asked the dwarf.

"Out of my path, busybody!" replied the young man. "I am in haste, and you will hinder me."

"That I will," replied the dwarf; and he cast the same enchantment upon him.

When neither of the brothers returned, the youngest prince of all determined to start. So at daybreak he set out on his white horse, and rode on till he came to where the dwarf stood.

"Whither away?" asked the dwarf.

"I go in search of the Water of Life," replied the youth. "My father is dangerously ill, and if you can guide me to the place where this magic water lies, I shall indeed be grateful."

"Well spoken!" cried the dwarf. "The Water of Life springs from a well in an enchanted castle. With this rod and these two loaves you may

go in safety. When you reach the door, strike it three times with this rod, and it will fly open. Within are two lions, waiting for prey. But have no fear; throw them this magic bread, and they will not molest you. Hasten to the well, and take some of the water, but see that you do not linger, for at twelve the door shuts, and you will be lost."

Thanking him for his friendly aid, the prince hurried on until he came to the enchanted castle, where he found every thing just as the dwarf had said. With the aid of the rod and the loaves, he found no difficulty in entering the castle. In a great hall, the remains of a banquet lay on a table, and the prince picked up a loaf and slipped it into his pocket, and took a sword from a knight who lay asleep and thrust it in his belt.

At the end of the room, partly hidden by a silken curtain, lay the most beautiful girl the young man had ever seen. As he approached, she sat up.

"At last you have come, my prince!" she cried. "For a hundred years I have been awaiting you. Marry me, and the enchantment which is on this castle will vanish."

The prince was only too willing to have such a lovely bride, but he begged her to direct him to the magic well, promising to return in a year. The princess told him, and the prince filled his flask with the precious water, and was soon on his journey home.

In due course he came upon the dwarf, to whom he related his adventures.

"You have done well," said the dwarf. "With that sword you can slay whole armies, and that loaf will never grow smaller, however much of it you eat."

But the prince had not forgotten his brothers, and he asked the dwarf if he could tell him where they were.

"They were proud and ill-behaved," answered the dwarf; "and so I laid a spell on them for punishment."

The prince begged so hard that the dwarf set them free, and the three brothers set out for their father's palace.

One night, while the young prince slept, his brothers began to plot how they might steal the Water of Life. "For," said they, "our father will be so pleased with our brother that he will leave him the kingdom that should come to us." So they stole the magic water and refilled the flask with sea-water.

When they reached the palace, the young man hastened to his father's bedside and gave him the water. But the sea-water made the king worse than he had been before. Then the elder brothers came forward with the real Water of Life; the king drank of it, and was instantly cured. A great feast was given in honor of the two brothers, but the people were so furious with the youngest son that they succeeded in persuading the king to consent to his death. But soon the old man began to blame himself bitterly for allowing his favorite son to be killed.

"My son! Ah, my son!" he cried. "How could I have been so cruel?"

At these words the servant who had been charged to slay his son fell on his knees before him, and confessed that he had not had the heart to put the prince to death, but had hidden him in a wood.

The king gave orders for his son to be brought to him without delay. But when they reached the wood the young prince could not be found.

A full year had now elapsed since the finding of the enchanted castle, and the eldest brother determined to win the lovely princess and her kingdom. The second prince had the same thought, but he said nothing to his brother.

Now, the princess was determined that none but the rightful prince should share her kingdom, and so she gave instructions for a road of pure gold to be made, leading to the castle gates.

"My prince will ride up that shining path, turning neither to right nor to the left," she said to her courtiers. "When he arrives, admit him; but open to no other."

When the eldest brother saw the golden road, he thought it a pity to spoil anything so beautiful, so he turned his horse and rode along by the side of it. But when he arrived at the gates the courtiers refused to admit him.

By and by the second brother rode up. "What a beautiful road!" he thought. And he, too, rode by the side and was refused admittance.

At last the youngest prince, seated on a beautiful white horse, approached the castle. So anxious was he to see his lovely princess again that he never even glanced at the golden road, but rode straight up to the gates, which were flung open to receive him.

There, at the foot of the steps, stood the princess in her bridal robes, with a smile of welcome in her eyes. The marriage took place without delay, and the prince with his lovely bride went back to his father's palace, where they were received with great joy.

The elder brothers were banished, and when the old king died, the young prince and his bride reigned together.

MERRYMIND, THE LITTLE FIDDLER

A TALE TOLD BY GRANNY'S WONDERFUL CHAIR

ONCE upon a time there lived a certain poor man and his wife, who had thirteen children. Twelve of these children were called by names common in the north country—Hardhead, Stiffneck, Tightfingers, and the like; but when the thirteenth came to be named, either the poor man and his wife could remember no other name, or something in the child's look made them think it proper, for they called him Merrymind.

When the youngest was old enough to look after his father's sheep, there happened the great fair, to which everybody in the country went.

Merchants and dealers from far and near crowded to the fair. The poor man who had the large family could afford them little to spend; but, as the fair was held only once in seven years, he opened the leathern bag in which his savings were stored, and gave every one of the thirteen children a silver penny.

The boys and girls had never before owned so much pocket-money; and, wondering what they should buy, they dressed themselves in their holiday clothes, and set out with their father and mother to the fair.

It was surprising how far silver pennies went in those days; but before evening twelve of the thirteen had spent their money. All had provided themselves with bargains except Merrymind.

The cause of the silver penny remaining in his pocket was that he had set his heart upon a fiddle; and fiddles enough there were at the fair, but there was not one that cost so little as a silver penny.

There was a stall of fiddles kept by a young merchant from a far country, who had many customers, his goods being fine and new; but near by sat a little grey-haired man, at whom everybody had laughed that day, because he had nothing for sale but one old dingy fiddle, and all its strings were broken.

"Buy a fiddle, my young lad?" he said, as Merrymind came forward. "You shall have it cheap; I ask but a silver penny for it; and if the strings were mended, its like would not be found in the whole of the north country."

Merrymind thought this a great bargain. He was a handy boy, and could mend the strings while watching his father's sheep. So down went the silver penny on the little man's stall, and up went the fiddle under Merrymind's arm.

"Now, my little lad,'' said the little man, "if you help me to pack my stall, I will tell you a wonderful piece of news about that fiddle. It is certain the strings can never be mended, nor made new, except by threads from the night-spinners, which, if you get, will be a good pennyworth."

Merrymind made haste to join the rest of the family, who were soon on their way home. When they got there everyone showed his bargain, and Merrymind showed his fiddle; but his brothers and sisters laughed at him for buying such a thing when he had never learned to play. His sisters asked him what music he could bring out of broken strings; and his father said:

"You have shown little prudence in using your first penny, and I fear you will never have many to spend."

Merrymind tried to repair the strings; but, true to the little man's parting words, no string would hold on that fiddle.

In the meantime, Merrymind lost credit at home, and, as nobody cared for him except his mother, he resolved to go to seek his fortune.

So Merrymind set out one summer morning, with the broken-stringed fiddle under his arm.

There were no highways then in the north country, so Merrymind went over the fair ground and over the hill. On the other side it was steep and rocky, and, after a hard scramble down, he came to a narrow glen all overgrown with wild furze and brambles.

Merrymind was weary with his long journey, and stood thinking of what

path to choose, when, by the way of the valley, there came an old man as tall and large as any three men of the north country. On his back he carried a heavy burden of dust, heaped high in a great basket.

"BUY A FIDDLE, MY YOUNG LAD?" SAID A LITTLE GREY-HAIRED MAN TO MERRYMIND

"Listen to me, you lazy fellow!" he said, coming near to Merrymind. "If you take the way through the wood, I know not what will happen to you, but if you choose this path, you must help me with my basket."

"Well, father," said Merrymind, "you seem tired, and I am younger than you, so, if you please, I will help you to carry the basket along the road." Hardly had he spoken when the huge man caught hold of him, firmly bound one side of the basket to his shoulders, and never ceased scolding and calling him names as they marched over the stony ground together. It was a rough way, and a heavy burden, but Merrymind began to sing an old rhyme which his mother had taught him. By this time they had entered the valley, and

the night had fallen very dark and cold. The old man ceased scolding, and Merrymind saw that they were close to a

"LISTEN TO ME, YOU LAZY FELLOW!" HE SAID

deserted cottage, for its door stood open. Here the old man paused, and loosened the rope from his own and Merrymind's shoulders.

"For seven times seven years," he said, "have I carried this basket, and no one ever sang while helping me before. Where will you sleep—by my kitchen fire or in that cold cottage?" Merrymind thought he had had quite enough of the old man's society, and therefore answered without hesitation:

"The cottage, good father, if you please."

Merrymind stepped into the deserted cottage. The hearth looked as if there had not been a fire there for years. Not a single article of furniture was to be seen. But Merrymind was very tired, and, lying down in a corner, with his fiddle close by, he fell fast asleep.

The floor was hard, and his clothes were thin; but all through his sleep there came a sweet sound of singing voices and spinning-wheels, and Merrymind thought he must have been dreaming when he opened his eyes next morning. He ate half a barley cake, drank from a stream close by, and went out to see the valley.

It was full of people, and they were all busy in houses and in fields, in mills and in forges. The men hammered and dug; the women scrubbed and scoured; the very children were hard at work; but Merrymind could hear neither talk nor laughter among them. Every face looked careworn and sad, and every word was something about work or gain.

Merrymind thought this strange, for everybody appeared rich. The women scrubbed in silk, the men dug in scarlet clothes. Crimson curtains, marble floors, and shelves of silver cups were to be seen in every house; but their owners took no pleasure in them, and everyone labored, as it were, for life.

In the middle of the valley there stood a stately castle. The gates were open, and Merrymind ventured in. In the highest tower of that busy castle, at a window from which she could see the whole valley, there sat a noble lady. Her dress was rich, but of a dingy drab color. Her hair was iron-grey; her look was sad and gloomy. Round her sat twelve maidens, spinning on old distaffs; and the lady spun as hard as they; but all the yarn they made was jet black.

No one in or out of the castle would speak to Merrymind, or answer his questions. Everyone was too busy. All day Merrymind wandered about with his broken-stringed fiddle, and all day he

THEY WERE ALL BUSY IN HOUSES & IN FIELDS

saw the old man marching round and round the valley with his heavy burden of dust.

In the evening, near the deserted cottage, Merrymind met the old man.

"Good father," he said, "tell me what games the people of this valley have."

"Games!" cried the old man, in great anger. "There are no games in Dame Dreary's land, I can assure you."

That night the boy did not sleep so well, but he was sure there had been singing and spinning near him all night.

Next day a heavy mist shut out sun and sky; the same hard work went forward wherever he turned his eyes; and the great old man with the dust-pannier strode on his accustomed round. Merrymind wandered away till he came to the farthest end of the valley.

There, there was no work, for the land lay bare and lonely, and was bounded by grey crags, as high and steep as any castle wall. There was no passage or outlet, except through a great iron gate secured with a heavy padlock. Close by it stood a white tent, and in the doorway a tall soldier, with one arm, stood smoking a long pipe. He was the first idle man Merrymind had seen in the valley, and his face looked to him like that of a friend; so the boy said:

"Master soldier, will you please tell me what country is this, and why do the people always work so hard?"

"Hold my pipe, and I will tell you," said the soldier, "for nobody else will take the time. The valley belongs to the lady of yonder castle, whom, for seven times seven years, men have called Dame Dreary. She had another name in her youth—they called her Lady Littlecare; and then the valley was the fairest spot in all the north country. Strongarm, the last of the giants, kept the pine forest, and hewed logs out of it, when he was not sleeping in the sun.

"Two fair maidens, clothed in white, with silver wheels on their shoulders, came by night, and spun golden threads by the hearth of every cottage. The

"HONORABLE LADIES, I PRAY YOU GIVE A POOR BOY A THREAD TO MEND HIS FIDDLE-STRINGS"

people had merry times. All that was changed, nobody knows how, for the old folks who remembered it are dead. Some say it was because of a magic ring which fell from the lady's finger; some because of a spring in the castle court which went dry. However it was, the lady turned Dame Dreary. The fairies departed; the giant Strongarm grew old, and took up a burden of dust; and the night-spinners were seen no more in any man's dwelling. They say it will be so till Dame Dreary lays down her distaff and dances; but all the fiddlers of the north country have tried their merriest tunes to no purpose."

"If my fiddle were mended, it would be a good thing," said Merrymind. And he then went home to sleep in the deserted cottage.

It was late when he came near it, and the moonlight night looked lovely beside the misty day. Merrymind thought it was a good time for trying to get out of the valley. There was no one about, and no appearance of the giant; but as Merrymind drew near to where the two paths met, there he was fast asleep. He tried to steal past; but Strongarm started up, and pursued him with stones half-way back to the old cottage.

THE DAME DANCED WITH ALL HER MIGHT

Merrymind was glad to run the whole way for fear of him. The door was still open, and the moon was shining in; but by the fireless hearth there sat two fair maidens, all in white, spinning on silver wheels, and singing together like the larks on a May morning. Merrymind could have listened all night; but he suddenly thought that these must be the night-spinners, whose threads would mend his fiddle; so he said:

"Honorable ladies, I pray you give a poor boy a thread to mend his fiddle-strings."

"For seven times seven years," said the fair maidens, "have we spun by night in this deserted cottage, and no mortal has seen or spoken to us. Go and gather sticks through all the valley to make a fire for us on this cold hearth, and each of us will give you a thread for your pains."

Merrymind took his broken fiddle with him, and went through all the valley gathering sticks by the moonlight; but so careful were the people of Dame Dreary's land that scarcely a stick could be found, and the moon was gone before he was able to come back with a small bundle. The cottage door was still open; the fair maidens and their silver wheels were gone; but, to his great surprise, on the floor where they had sat lay two long threads of pure gold. Merrymind first heaped up his wood on the hearth, to be ready against their coming at night, and next took up the golden threads to mend his fiddle. Then he learned the truth of the little man's saying at the fair, for no sooner were the strings fastened with those golden threads than they became firm. The old dingy fiddle, too, began to shine and glisten, and at length it was golden also. This sight made Merrymind so joyful that, although he had never studied music, the boy tried to play. Scarcely had his bow touched the strings when they began to play of themselves the same pleasant tune which the night-spinners sang together.

"Some of the workers will stop for the sake of this tune," said Merrymind; and he went out along the valley with his fiddle.

The music filled the air; the busy people heard it; and never was such a day seen in Dame Dreary's land. The men paused in their delving; the women stopped their scrubbing; the little children dropped their work, and

everyone stood still in their places while Merrymind and his fiddle passed on. When he came to the castle, Dame Dreary's distaff stood still in her hand. Merrywind played through the halls and up the tower stairs. As he came near, the dame cast down her distaff, and danced with all her might. All her maidens danced too; and as they danced she grew young again. They brought her the dress of white and cherry color she used to wear in her youth, and she was no longer Dame Dreary, but the Lady Littlecare, with golden hair and laughing eyes.

Then a sound of merry-making came up from the whole valley. Strongarm tossed the basket of dust from his shoulder, and lay down to sleep in the sun. That night the fairies danced on the hill-tops; and the night-spinners, with their silver wheels, were seen by every hearth. Everbody praised Merrymind and his fiddle; and when news of his wonderful playing came to the king's ears, he promoted Merrymind to be his first fiddler, which, under that wise monarch, was the highest post in his kingdom.

As soon as Merrymind's family and neighbors heard of the high position his fiddle had gained for him, they thought music must be a good thing, and man, woman, and child took to fiddling. It is said that none of them ever learned to play a single tune except Merrymind's mother, on whom her son bestowed many nice presents.

THE RABBI IN THE DESERT

A FAMOUS Jewish rabbi named Akiba was driven by persecution from his native land, and compelled to wander over the dreary desert.

His whole possessions consisted of a lamp, which he used to light at night in order to study a book containing the sacred law; a cock, which used to wake him in good time in the morning by its crowing; and an ass, on which he rode.

One evening the rabbi felt almost too exhausted to go farther, and wondered where he could find shelter for the night. He saw ahead of him a village, and determined to press on and ask for a lodging.

Astonishing to relate, however, not one of the churlish inhabitants of that village would give the weary traveler shelter, and, disappointed and fatigued, he was compelled to make his way into a wood.

"It is hard," said the rabbi, "to think that no one will allow me to take shelter for the night; but, after all, God is just, and whatever He does must be best."

Seating himself under a tree, he lit his lamp, and began to read out of the book of the law. He had only read a few lines when a gust of wind blew out the light.

"What!" exclaimed the rabbi. "Am I not permitted even to read? But God is just, and whatever He does must be best."

He stretched himself out on the cold, bare earth, trying to get a few hours' sleep. But just as he was dozing off there was a noise, and he woke to find a fierce wolf hurrying past with a bird in its mouth. It was his favorite bird, the cock that woke him every morning.

"Alas!" cried he, "what new misfortune is this that has overtaken me? The cock, who has been my vigilant companion for so long, is gone. Who now will awaken me to the study of the law? But, after all, God is just, and whatever He does must be best."

Scarcely had he lain down again when a lion sprang upon his ass, and carried it off into the darkness.

"What am I to do now?" cried the distressed rabbi. "My light, my bird, and my poor ass are all gone, and I must wander alone. But, praise be to God, He is just, and what He does must be best."

After a sleepless night, the rabbi went to the village to see if he could obtain a horse to carry him on his way. But what was his surprise and horror to find that all the houses had been plundered and their inhabitants killed during the night by a band of robbers.

"Forgive me, Lord, for complaining," said he, as he turned his face upward. "Had not the people driven me from their village I should certainly have shared their fate; had not the wind blown out my light the robbers would have been attracted to the spot, and have killed me also; and hadst Thou not deprived me of my two companions their noise would also have brought the robbers. Praise be to Thee for ever; Thou art just, and what Thou doest is best."

A BALLAD OF THE BORDERLAND

THE beautiful country, on both sides of the Cheviots, known as the Borderland is a region of green hills and valleys, where the waters of many streams make music as they flow. This Borderland has always been famous for its legends, and many ballads have been collected in which these legends are told. James Hogg gave a new dress of poetry to one of these old legends in his famous ballad of "Kilmeny." The story was an old one long before the poet heard it, and he told it in the beautiful musical way of an old ballad. Kilmeny is a lovely girl lost in the woods, and for seven years her mother mourns her. Then one day she comes home. She is strangely quiet, though, if anything, more beautiful than ever. She had been stolen away by the fairies, as she was so pure and lovely. Then her heart had yearned for her old home, and the fairies let her go back. But after a month and a day Kilmeny wanders again to the greenwood, and, lying down there, the fairies bear her away where everything is as pure and beautiful as Kilmeny herself, and she returns no more.

KILMENY: A FAIRY LEGEND

CONTINUED FROM 4341

BONNY Kilmeny gaed up the glen;
But it wasna to meet Duneira's men,
Nor the rosy monk of the isle to see,
For Kilmeny was pure as pure could be.
It was only to hear the Yorlin sing,
And pu' the cress-flower round the spring;
The scarlet hyppe, and the hindberry,
And the nut that hung frae the hazel-tree;
For Kilmeny was pure as pure could be.
But lang may her minny look o'er the wa',
And lang may she seek i' the greenwood shaw;
Lang the laird of Duneira blame,
And lang, lang greet or Kilmeny come hame!

When many lang day had come and fled,
When grief grew calm, and hope was dead,
When Mass for Kilmeny's soul had been sung,
When the bedes-man had prayed, and the deadbell rung:
Late, late in the gloamin' when all was still,
When the fringe was red on the westlin hill,
The wood was sere, the moon i' the wane,
The reek o' the cot hung o'er the plain,
Like a little wee cloud in the world its lane;
When the ingle lowed with an eiry leme,
Late, late in the gloamin' Kilmeny came hame!

"Kilmeny, Kilmeny, where have you been?
Lang hae we sought baith holt and dean;
By linn, by ford, and greenwood tree,
Yet you are halesome and fair to see.
Where gat you that joup o' the lily sheen?
That bonny snood o' the birk sae green?
And these roses the fairest that ever was seen?
Kilmeny, Kilmeny, where have you been?"
Kilmeny looked up with a lovely grace,
But nae smile was seen on Kilmeny's face;
As still was her look, and as still was her ee,
As the stillness that lay on the emerant lea,
Or the mist that sleeps on a waveless sea.
For Kilmeny had been she ken'd not where,
And Kilmeny had seen what she could not declare:
Kilmeny had been where the cock never crew,
Where the rain never fell and the wind never blew.
But it seemed as the harp of the sky had rung,
And the airs of heaven played round her tongue,
When she spake of the lovely forms she had seen,
And a land where sin had never been:
A land of love, and a land of light,
Withouten sun, or moon, or night;
Where the river swa'd a living stream,
And the light a pure and cloudless beam.
The land of vision it would seem,
A still, an everlasting dream.

In yon greenwood there is a waik,
And in that waik there is a wene,
And in that wene there is a maike,
That neither has flesh, nor blood, nor bane;
And down in yon greenwood he walks his lane.

In that green wene Kilmeny lay,
Her bosom happ'd wi' flowerets gay;
But the air was soft and the silence deep,
And bonny Kilmeny fell sound asleep.
She kenned nae mair, nor open'd her ee,
Till waked by the hymns of a far countrye.

She woke on a couch of the silk sae slim,
All striped wi' the bars of the rainbow's rim;
And lovely beings round were rife,
Who erst had travelled mortal life;
And aye they smiled and 'gan to speer,
"What spirit has brought this mortal here?"

"Lang have I ranged the world wide,"
A meek and reverend fere replied;
"Baith night and day I have watched the fair
Eident a thousand years and mair.
Yes, I have watched o'er ilk degree,
Wherever blooms femenitye;
And sinless virgin, free of stain
In mind and body, fand I nane.
Never, since the banquet of time,

Found I a virgin in her prime,
Till late this bonnie maiden I saw
As spotless as the morning snaw:
Full twenty years she has lived as free
As the spirits that sojourn in this countrye:
I have brought her away frae the snares of men,
That sin or death she never may ken."

They clasped her waist and her hands sae fair,
They kissed her cheek, and they kemed her hair;
And round came many a blooming fere,
Saying: "Bonny Kilmeny, ye're welcome here!
Women are freed of the littand scorn:
O, blessed be the day Kilmeny was born!
Now shall the land of the spirits see,
Now shall it ken what a woman may be!
Many lang year through the world we've gane,
Commissioned to watch fair womankind,
For it's they who nurse the immortal mind.
We have watched their steps as the dawning shone,
And deep in the greenwood walks alone;
By lily bower and silken bed,
The viewless tears have o'er them shed;
Have soothed their ardent minds to sleep,
Or left the couch of love to weep.
We have seen! we have seen! but the time maun come,
And the angels will weep at the day of doom!

"O, would the fairest of mortal kind
Aye keep these holy truths in mind,
That kindred spirits their motions see,
Who watch their ways with anxious ee,
And grieve for the guilt of humanitye.
O, sweet to Heaven the maiden's prayer,
And the sigh that heaves a bosom sae fair.
And dear to Heaven the words of truth,
And the praise of virtue frae beauty's mouth.
And dear to the viewless forms of air,
The mind that kythes as the body fair,

"O bonny Kilmeny! free frae stain,
If ever you seek the world again,
That world of sin, of sorrow, and fear,
O, tell of the joys that are waiting here;
And tell of the signs you shall shortly see;
Of the times that are now, and the times that shall be."

They lifted Kilmeny, they led her away,
And she walked in the light of a sunless day:
The sky was a dome of crystal bright,
The fountain of vision, the fountain of light:
The emerant fields were of dazzling glow,
And the flowers of everlasting blow.
Then deep in the stream her body they laid,
That her youth and beauty never might fade;
And they smiled on heaven, when they saw her lie
In the stream of life that wandered by.
And she heard a song, she heard it sung,
She kend not where; but sae sweetly it rung,
It fell on her ear like a dream of the morn:
"O, blest be the day Kilmeny was born!
Now shall the land of the spirits see,
Now shall it ken what a woman may be!
The sun that shines on the world sae bright,
A borrowed gleid frae the fountain of light;
And the moon that sleeks the sky sae dun,
Like a gouden bow, or a beamless sun,
Shall wear away and be seen nae mair,
And the angels shall miss them travelling the air,
But lang, lang after baith night and day,
When the sun and the world have fled away;
When the sinner has gane to his waesome doom,
Kilmeny shall smile in eternal bloom!"

They bore her away, she wist not how,
For she felt not arm nor rest below;
But so swift they wained her through the light,
'Twas like the motion of sound or sight;
They seemed to split the gales of air,
And yet nor gale nor breeze was there.
Unnumbered groves below them grew;
They came, they past, and backward flew,
Like floods of blossoms gliding on,
A moment seen, in a moment gone.
O, never vales to mortal view
Appeared like those o'er which they flew!
That land to human spirits given,
The lowermost vales of the storied heaven;
From thence they can view the world below,
And heaven's blue gates with sapphires glow,
More glory yet unmeet to know.

They bore her far to a mountain green,
To see what mortal never had seen;
And they seated her high on a purple sward,
And bade her heed what she saw and heard;
And note the changes the spirits wrought,
For now she lived in the land of thought.
She looked, and she saw nor sun nor skies,
But a crystal dome of a thousand dyes;
She looked, and she saw nae land aright,
But an endless whirl of glory and light;
And radiant beings went and came
Far swifter than wind, or the linked flame.
She hid her een frae the dazzling view;
She looked again, and the scene was new.

She saw a sun on a summer sky,
And clouds of amber sailing by;
A lovely land beneath her lay,
And that land had lakes and mountains gray;
And that land had valleys and hoary piles,
And marled seas and a thousand isles.
Its fields were speckled, its forests green,
And its lakes were all of the dazzling sheen,
Like magic mirrors, where slumbering lay
The sun and the sky, and the cloudlet gray;
Which heaved and trembled, and gently swung,
On every shore they seemed to be hung:
For there they were seen on their downward plain
A thousand times, and a thousand again;
In winding lake, and placid firth,
Like peaceful heavens in the bosom of earth.

Kilmeny sighed and seemed to grieve,
For she found her heart to that land did cleave;
She saw the corn wave on the vale,
She saw the deer run down the dale;
She saw the plaid and the broad claymore,
And the brows that the badge of freedom bore;
And she thought she had seen the land before.

She saw a lady sit on a throne,
The fairest that ever the sun shone on:
A lion licked her hand of milk,
And she held him in a leish of silk;
And a leifu' maiden stood at her knee,
With a silver wand and melting ee;
Her sovereign shield till love stole in,
And poisoned all the fount within.

Then a gruff untoward bedes-man came,
And hundit the lion on his dame;
And the guardian maid wi' the dauntless ee,
She dropped a tear, and left her knee;
And she saw till the queen frae the lion fled,
Till the bonniest flower of the world lay dead;
A coffin was set on a distant plain,
And she saw the red blood fall like rain;
Then bonny Kilmeny's heart grew sair,
And she turned away, and could look nae mair.

Then the gruff grim carle girnèd amain,
And they trampled him down, but he rose again;
And he baited the lion to deeds of weir,
Till he lapped the blood to the kingdom dear;
And weening his head was danger-preef,
When crowned with the rose and clover-leaf,
He gowled at the carle, and chased him away,
To feed wi' the deer on the mountain gray.
He gowled at the carle, and he gecked at Heaven;
But his mark was set, and his arles given.
Kilmeny a while her een withdrew;
She looked again, and the scene was new.

She saw below her fair unfurled
One half of all the glowing world,
Where oceans rolled, and rivers ran,
To bound the aims of sinful man.
She saw a people, fierce and fell,
Burst frae their bounds like fiends of hell;
There lilies grew, and the eagle flew,
And she herked on her ravening crew,
Till the cities and towers were wrapped in a blaze,
And the thunder it roared o'er the lands and the seas.
The widows they wailed, and the red blood ran,
And she threatened an end to the race of man:
She never lened, nor stood in awe,
Till caught by the lion's deadly paw.
Oh! then the eagle swinked for life,
And brainzelled up a mortal strife;
But flew she north, or flew she south,
She met wi' the gowl of the lion's mouth.

With a mooted wing and waefu' maen,
The eagle sought her eiry again;
But lang may she cower in her bloody nest,
And lang, lang sleek her wounded breast,
Before she sey another flight,
To play wi' the norland lion's might.

But to sing the sight Kilmeny saw,
So far surpassing Nature's law,
The singer's voice wad sink away,
And the string of his harp wad cease to play.
But she saw till the sorrows of man were by,
And all was love and harmony;
Till the stars of heaven fell calmly away,
Like the flakes of snaw on a winter's day.
Then Kilmeny begged again to see
The friends she had left in her own countrye,
To tell of the place where she had been,
And the glories that lay in the land unseen;
To warn the living maidens fair,
The loved of Heaven, the spirits' care,
That all whose minds unmeled remain
Shall bloom in beauty when time is gane.

With distant music, soft and deep,
They lulled Kilmeny sound asleep;
And when she awakened, she lay her lane,
All happed with flowers in the greenwood wene,
When seven lang years had come and fled;
When grief was calm, and hope was dead;
When scarce was remembered Kilmeny's name,
Late, late in a gloaming Kilmeny came hame.
And O, her beauty was fair to see,
But still and steadfast was her ee!
Such beauty bard may never declare,
For there was no pride nor passion there;
And the soft desire of maiden's een
In that mild face could never be seen.
Her seymar was the lily-flower,
And her cheek the moss-rose in the shower;
And her voice like the distant melodye,
That floats along the twilight sea.
But she loved to raike the lanely glen,
And keep afar frae the haunts of men;
Her holy hymns unheard to sing,
To suck the flowers and drink the spring.
But wherever her peaceful form appeared,
The wild beasts of the hills were cheered;
The wolf played blythely round the field,
The lordly byson lowed and kneeled;
The dun deer wooed with manner bland,
And cowered aneath her lily hand.
And when at eve the woodlands rung,
When hymns of other worlds she sung
In ecstasy of sweet devotion,
O, then the glen was all in motion!
The wild beasts of the forest came,
Broke from their boughts and faulds the tame,
And goved around, charmed and amazed;
Even the dull cattle crooned and gazed,
And murmured and looked with anxious pain,
For something the mystery to explain.
The buzzard came with the throstle-cock;
The corby left her houf in the rock;
The blackbird alang wi' the eagle flew;
The hind came tripping o'er the dew;
The wolf and the kid their raike began,
And the tod, and the lamb, and the leveret ran;
The hawk and the hern attour them hung,
And the merl and the mavis forhooyed their young;
And all in a peaceful ring were hurled—
It was like an eve in a sinless world!

When a month and day had come and gane,
Kilmeny sought the greenwood wene;
There laid her down on the leaves sae green;
And Kilmeny on earth was never mair seen.
But O, the words that fell from her mouth
Were words of wonder and words of truth!
But all the land were in fear and dread,
For they kendna whether she was living or dead.
It wasna her hame, and she couldna remain;
She left this world of sorrow and pain,
And returned to the land of thought again.

OPPORTUNITY

The writer of this short poem was Edward Rowland Sill, an American poet, who died early in life, but who, had he been spared, might have been one of the greatest poets the American nation has produced. His theme here is an old one, the contrast between the man who sighs for the opportunity to do great things and the man who does them by seizing whatever means exist, thus making the opportunity. It is an old theme, but the poet, by the sheer pith and compression of his verse, enforces the moral upon our minds as if it were the first time it had been conveyed to us.

THIS I beheld, or dreamed it in a dream—
There spread a cloud of dust along a plain;
And underneath the cloud, or in it, raged
A furious battle, and men yelled, and swords
Shocked upon swords and shields. A prince's banner
Wavered, then staggered backward, hemmed by foes.

A craven hung along the battle's edge,
And thought, "Had I a sword of keener steel—
That blue blade that the king's son bears—but this
Blunt thing!"—he snapped and flung it from his hand,
And lowering crept away, and left the field.

Then came the king's son, wounded, sore, bestead,
And weaponless, and saw the broken sword,
Hilt buried in the dry and trodden sand,
And ran and snatched it, and, with battle shout
Lifted afresh, he hewed the enemy down,
And saved a great cause that heroic day.

THE DISCOVERER

Edmund Clarence Stedman was a very distinguished American poet, who died at the beginning of 1908, in his seventy-fifth year. His writings are better known in America than they are in England, but the charm of his verse ought to make it widely read wherever the English tongue is spoken. In the following poem we have this fine writer in a tender mood, for the discoverer of whom he sings is just any little child that dies and all too soon sets out on the great mysterious journey to the unknown land. "The Discoverer" is really, in a sense, another view of "Peter Pan."

I HAVE a little kinsman
Whose earthly summers are but three,
And yet a voyager is he
Greater than Drake or Frobisher,
Than all their peers together!
He is a brave discoverer,
And, far beyond the tether
Of them who seek the frozen Pole,
Has sailed where the noiseless surges roll.
Ay, he has travelled whither
A winged pilot steered his bark
Through the portals of the dark,
Past hoary Mimir's well and tree,
Across the unknown sea.

Suddenly, in his fair young hour,
Came one who bore a flower,
And laid it in his dimpled hand
With this command:
"Henceforth thou art a rover!
Thou must make a voyage far,
Sail beneath the evening star,
And will a wondrous land discoverer."
With his sweet smile innocent
Our little kinsman went.

Since that time no word
From the absent has been heard.
Who can tell
How he fares, or answer well
What the little one has found
Since he left us, outward bound?
Would that he might return!
Then should we learn
From the pricking of his chart
How the skyey roadways part.
Hush! does not the baby this way bring,
To lay beside this severed curl,
Some starry offering
Of chrysolite or pearl?

Ah, no! not so!
We may follow on his track,
But he comes not back.
And yet I dare aver
He is a brave discoverer
Of climes his elders do not know.
He has more learning than appears
On the scroll of twice three thousand years,
More than in the groves is taught,
Or from furthest Indies brought;
He knows, perchance, how spirits fare,
What shapes the angels wear,
What is their guise and speech
In those lands beyond our reach,
And his eyes behold
Things that shall never, never be to mortal hearers told.

THE FLIGHT OF THE ARROW*

Richard Henry Stoddard was a notable American poet, born in 1825, who died in 1903. His poems were not so well known in other countries as those of other Americans, such as Longfellow, Whittier, and Lowell; but, for all that, he was a writer of distinction, and we are glad to include these lines of his, in which, following the example of Longfellow in his poem beginning "I shot an Arrow in the Air," he makes use of the arrow's flight to illustrate a great lesson in life.

THE life of man
Is an arrow's flight
Out of darkness
Into light,
And out of light
Into darkness again;
Perhaps to pleasure,
Perhaps to pain!

There must be Something,
Above, or below;
Somewhere unseen
A mighty Bow,
A Hand that tires not,
A sleepless Eye
That sees the arrows
Fly, and fly;
One who knows
Why we live—and die.

THE LORD'S PRAYER IN VERSE

The author of this versified Lord's Prayer is not known, and he was probably not much of a poet, nor can we say that the beautiful words of the Scripture are improved by being turned into rhyme. We give the lines here, as young readers find verse easier to memorize than prose.

FATHER in heaven, hallowed be Thy name,
Thy kingdom come; Thy will be done the same
In earth and heaven. Give us daily bread;
Forgive our sins as others we forgive,
Into temptation let us not be led,
Deliver us from evil while we live.
For kingdom, power, and glory must remain
For ever and for ever Thine: Amen.

*From poems of Richard Henry Stoddard, copyright, 1880, by Charles Scribner's Sons.

JESU! LOVER OF MY SOUL

There is no finer hymn in the English language than this beautiful composition by Charles Wesley, the brother of John Wesley, who founded the Methodist Church. Charles Wesley was born in 1707 and died in 1788, his life being full of religious activity and earnest spreading of the Gospel. In all he composed some six thousand hymns, only a few of which are still in use, but "Jesu! Lover of My Soul" is certainly unsurpassed in all the range of sacred song. It is said that the author was sitting one day at his desk when a bird, pursued by a hawk, flew in at the open window. The hawk, afraid to follow, flew away, and Wesley, struck by the incident, was at once inspired to write this song, applying what he had just witnessed to our spiritual life.

JESU! Lover of my soul,
Let me to Thy bosom fly;
While the nearer waters roll,
While the tempest still is high.
Hide me, O my Saviour, hide,
Till the storm of life is past;
Safe into the haven guide,
O receive my soul at last!

Other refuge have I none;
Hangs my helpless soul on Thee;
Leave, ah! leave me not alone,
Still support and comfort me!
All my trust on Thee is stayed,
All my help from Thee I bring;
Cover my defenceless head
With the shadow of Thy wing.

Wilt Thou not regard my call?
Wilt Thou not accept my prayer?
Lo! I sink, I faint, I fall,
Lo! on Thee I cast my care.
Reach me out Thy gracious hand!
While I of Thy strength receive;
Hoping against hope I stand,
Dying, and behold I live!

Thou, O Christ, art all I want,
More than all in Thee I find;
Raise the fallen, cheer the faint,
Heal the sick, and lead the blind.
Just and holy is Thy name,
I am all unrighteousness;
False and full of sin I am,
Thou art full of truth and grace.

Plenteous grace with Thee is found,
Grace to cover all my sin;
Let the healing streams abound,
Make and keep me pure within.
Thou of life the Fountain art,
Freely let me take of Thee;
Spring Thou up within my heart,
Rise, to all eternity!

A STANZA OF FREEDOM

James Russell Lowell, a well-known American poet, was always a sturdy singer in the cause of freedom. In these lines he admirably expresses the ideal of freedom, for it is better "to be in the right with two or three" and suffer in consequence than to be comfortably in the wrong with the many and thus escape "the troubles that afflict the just."

THEY are slaves who fear to speak
For the fallen and the weak;
They are slaves who will not choose
Hatred, scoffing, and abuse,

Rather than in silence shrink
From the truth they needs must think;
They are slaves who dare not be
In the right with two or three.

THE GOOD, GREAT MAN

Here is a short poem which may be described as a gem in every sense. The noble and inspiring thought which it contains is expressed in language of simple beauty and dignity. The lesson it teaches us is one easy to understand if difficult to put in practice! For the more we know of life the more sure shall we become that the poet is right in thinking "goodness and greatness are not means but ends." There is a familiar saying: "virtue is its own reward." This means that to do the right thing not for the sake of recompense or recognition, but merely for the sake of doing the right thing, is the greatest reward that virtue can obtain. That is the lesson to be learned from this fine little poem by Coleridge, the author of "The Ancient Mariner."

HOW seldom, friend, a good, great man inherits
Honour and wealth, with all his worth and pains!
It seems a story from the world of spirits
When any man obtains that which he merits,
Or any merits that which he obtains.

For shame, my friend, renounce this idle strain.
What wouldst thou have a good, great man obtain?
Wealth, title, dignity, a golden chain,
Or heap of corses which his sword hath slain?
Goodness and greatness are not means, but ends.

Hath he not always treasures, always friends,
The great, good man? Three treasures: love, and light,
And calm thoughts, equable as infant's breath;
And three fast friends, more sure than day or night;
Himself, his Maker, and the angel Death.

LORD, IT BELONGS NOT TO MY CARE

Richard Baxter was an English Presbyterian minister who had a long, eventful life between the years 1615 and 1691, being sometimes eminent in the religious affairs of his country, but in the later years of his life often subject to persecution. He wrote much both in prose and verse. The following is a good example of his religious poetry.

LORD, it belongs not to my care,
Whether I die or live;
To love and serve Thee is my share,
And this Thy grace must give.

If life be long I will be glad,
That I may long obey;
If short—yet why should I be sad
To soar to endless day?

Christ leads me through no darker rooms
Than He went through before;
He that into God's kingdom comes,
Must enter by His door.

Come, Lord, when grace hath made me meet
Thy blessed face to see;
For if Thy work on earth be sweet,
What will Thy glory be?

Then I shall end my sad complaints
And weary sinful days;
And join with the triumphant saints
To sing Jehovah's praise.

My knowledge of that life is small,
The eye of faith is dim;
But 'tis enough that Christ knows all,
And I shall be with Him.

LITTLE VERSES FOR VERY LITTLE PEOPLE

YOU are going out to tea to-day,
So mind how you behave;
Let all accounts I have of you
Be pleasant ones, I crave.

Don't spill your tea, or gnaw your bread,
And don't tease one another;
And Tommy mustn't talk too much,
Or quarrel with his brother.

Say "If you please," and "Thank you, Nurse."
Come home at eight o'clock;
And, Fanny, pray be careful that
You do not tear your frock.

Now, mind your manners, children five,
Attend to what I say;
And then, perhaps, I'll let you go
Again another day.

A LITTLE BOY THAT CRIED.

ONCE a little boy, Jack, was ever so good,
Till he took a strange notion to cry all he could.
So he cried all the day, and he cried all the night,
He cried in the morning and in the twilight;
He cried till his voice was as hoarse as a crow,
And his mouth grew as large as a capital O.
It grew at the bottom, and grew at the top;
It grew till they thought it never would stop.
Each day his mouth grew taller and taller.
And his dear little self grew smaller and smaller.
At last that same mouth grew so big that, alack!
It was only a mouth with a border of Jack.

DIDDLE, diddle dumpling, my son John,
He went to bed with his stocking on;
One shoe off, and one shoe on,
Diddle, diddle dumpling, my son John.

ON Christmas Eve I turned the spit,
I burnt my fingers, I feel it yet;
The cock sparrow flew over the table,
The pot began to play with the ladle;
The ladle stood up like an angry man,
And vowed he'd fight the frying-pan;

The frying-pan behind the door
Said he never saw the like before;
And the kitchen clock I was going to wind
Said he never saw the like behind.

GREAT A, little A,
This is pancake day;
Toss the ball high,
Throw the ball low,
Those that come after
May sing heigh-ho!

JACK JINGLE went 'prentice
To make a horse-shoe,
He wasted the iron
Till it would not do.
His master came in.
And began for to rail;
Says Jack: "The shoe's spoiled,
But 'twill still make a nail."

He tried at the nail,
But, chancing to miss,
Says: "If it won't make a nail,
It shall yet make a hiss."
Then into the water
Threw the hot iron, smack!
"Hiss!" quoth the iron;
"I thought so," says Jack.

NURSERY RHYMES OF CHILDREN OF FRANCE

JE suis un petit poupon
  De belle figure,
Qui aime bien les bonbons
  Et les confitures.
Si vous voulez m'en donner
Je saurai bien les manger—
  La bonne aventure! Oh, gai!
  La bonne aventure!

Lorsque les petits garçons
  Sont gentils et sages,
On leur donne des bonbons,
  De jolies images.
Mais quand ils se font gronder,
C'est le fouet qu'il faut donner—
  La triste aventure! Oh, gai!
  La triste aventure!

Je serai sage et bien bon,
  Pour plaire à ma mère;
Je saurai bien ma leçon,
  Pour plaire à mon père.
Je veux bien les contenter,
Et s'ils veulent m'embrasser—
  La bonne aventure! Oh, gai!
  La bonne aventure.

I'M a chubby little thing,
  Rather pretty too,
I *often* eat the sweets folks bring,
  And jam I *always* do.
Just give me some, and I will show
The way to eat them up I know.
  'Tis awful fun. Oh, joy!
  'Tis awful fun.

'Tis very nice when little boys
  Do just what boys should do;
Folks give them sweets and often toys,
  And pretty pictures too.
But when they're naughty, I believe,
A whipping then is what folks give.
  'Tis awful sad. Oh, joy!
  'Tis awful sad.

I will be very, very good,
  To please my dear Mamma,
And learn my lessons, as I should,
  To please my dear Papa.
I always want to do what's right
When Mummy cuddles me up tight.
  'Tis awful fun. Oh, joy!
  'Tis awful fun.

AH! vous dirai-je, Maman,
  Ce qui cause mon tourment!
Papa veut que je raisonne
Comme une grande personne;
Moi je dis que les bonbons
Valent mieux que la raison.

DARLING Mother, shall I say
  Why I feel so sad to-day?
Daddy thinks I ought to know
As much as quite a *big* fellow!
I think games, with sweets for prize,
Better far than being wise.

PAN! Qu'est-ce qu'est là?
    C'est Polichinelle,
  Mam'selle.
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

Toujours joyeux,
  Il aime fort la danse,
  Il se balance,
D'un petit air gracieux;
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

Il est mal fait
Et craint de vous déplaire
Mais il espère
Vous chanter son couplet;
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà

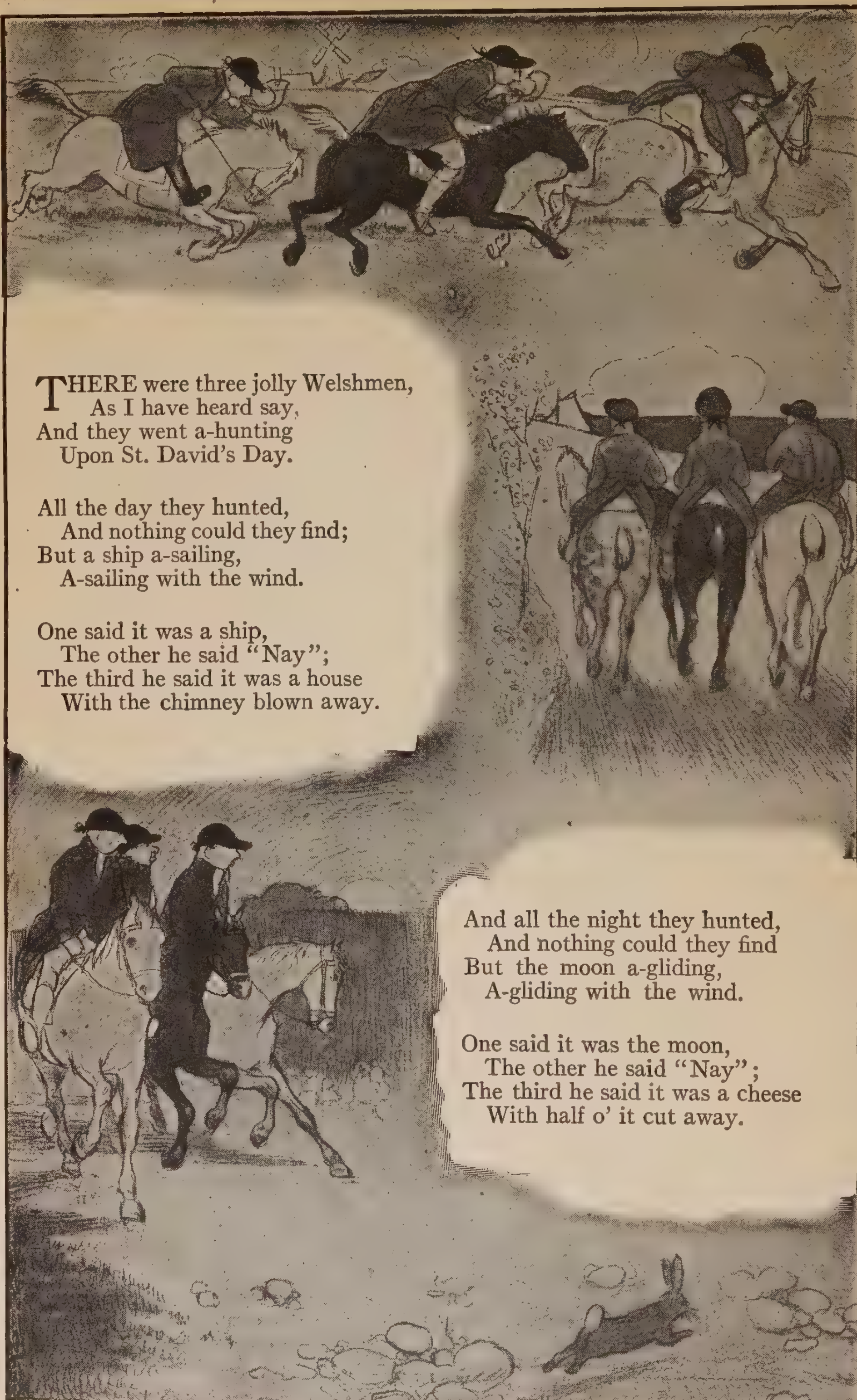
A vous faire rire,
Mes enfants, il aspire
Jeunes et vieux
Ceux qui rient sont heureux;
Pan! Qu'est-ce qu'est là?
C'est Polichinelle, que voilà!

HALT! Who goes there?
    Punchinello,
  My fine fellow!
Halt! Who goes there?
Punchinello! Right here!

Always debonnair,
  He is fond of a dance,
  To retire and advance,
With a courtly air.
Halt! Who goes there?
Punchinello! Right here!

He fears he is wrong;
  But yet, in despite,
He'll sing you a song,
  If you will invite.
Halt! Who goes there?
Punchinello! Right here!

To cure all who mope,
My friends, is his hope.
Laugh, Age and Youth,
And be happy in truth.
Halt! Who goes there?
Punchinello! Right here!



THERE were three jolly Welshmen,
  As I have heard say,
And they went a-hunting
  Upon St. David's Day.

All the day they hunted,
  And nothing could they find;
But a ship a-sailing,
  A-sailing with the wind.

One said it was a ship,
  The other he said "Nay";
The third he said it was a house
  With the chimney blown away.

And all the night they hunted,
  And nothing could they find
But the moon a-gliding,
  A-gliding with the wind.

One said it was the moon,
  The other he said "Nay";
The third he said it was a cheese
  With half o' it cut away.

In the first picture we see a section of the eyeball between the blind spot and the optic nerve. The middle picture shows the interior of the eyeball, with the nerve-fibres radiating from the blind spot. In the third, a part of the retina is highly magnified, showing the various layers and rods and cones.

THE LIGHT IN OUR EYES

CONTINUED FROM 4334

WE know all about the lens of the eye, and now we must trace the light after it has passed through the lens, and note what next happens to it. As the pictures on page 4329 show, there is still the greater part of the eyeball for the light to pass through, whether the eyeball be long or short. This part of the eye is entirely filled with a sort of jelly, made of a large number of thin sheets. The name for it means that it is like a piece of glass, while the stuff that fills the front part of the eye, between the cornea and the iris, is quite watery.

At the back of this part of the eye, where the glassy material lies, is the retina, the sensitive plate or curtain where we find the all-important nerve-cells. Before we study it, we must just observe what has happened to the light in the course of its passage through four different things—the cornea, the watery fluid behind it, the lens, and the jelly-like material behind the lens.

In the first place, we must note that in health all these materials are practically transparent, although they cannot be quite transparent, and we know that they throw back a certain amount of light, because when we look at anyone's eye we can see a little picture reflected from the surface of it, showing that all the light which reaches it does not go through. More important than this slight loss of light is the fact that, as we sometimes notice, there are dark patches or spots in our field of vision, and we say that we have "spots before our eyes." These spots are of two kinds—those which are always there and in the same place, and those which are just seen for a time and then disappear. Permanent spots before the eyes are due to some fault in the cornea or in the lens.

There has been some little injury done to the cornea, or some cause of disturbance has occurred in the lens; and in the course of recovery there has been made what is called scar-tissue. Nothing can be done to remove these spots, but, fortunately, people usually become used to them and take no notice of them.

The other kind of spots before the eyes come and go. As a rule we notice them only when we are not very well. They are most commonly seen in the morning by people who have gone to bed too late at night, especially if they have eaten or drunk more than is good for them. With time and a little careful living, and especially

a dose of medicine to clear the blood, these spots disappear. The cause of them is extremely interesting. What produces the spots is to be found there in the eye, perhaps little kinks in the folds of the jelly-like material, perhaps a few white blood-cells that are wandering about on some business of their own, and get in the way of the light, just as a person's head may get in the way at a magic-lantern show and cause a shadow.

THE HEALTHY EYE SHOULD NOT NOTICE LITTLE THINGS THAT IRRITATE

The healthy eye does not notice these things; it is sensitive, but it is not too sensitive. When, however, any part of the body, and especially such a thing as the eye or the ear, is not quite well, or when the body, as a whole, is rather out of form, then these sensitive places become too sensitive; they become irritable, and this is known as the irritability of weakness. It is true not only of a weak eye or a weak ear or of a weak body in general, but it is also true of a weak mind, of weak judgment and weak feelings. If it continues, the results are apt to be very harmful indeed.

The eye in health ought to ignore trifles of no importance inside itself, and it ought to be able to stand a fair amount of light without injury. The healthy ear ought to ignore little disturbances going on inside itself due to the circulation of the blood, movement of the bones and muscles in the middle ear, and so on; it ought to hear no sounds from these causes.

But the eye or the ear that has been overstrained, and has become weak, is bothered by seeing spots or by hearing a singing in the ears, and the case may become much worse, because, in the case of the eye, there are very likely horrid dreams in which unpleasant things are seen, or if it is especially the ear that has been overstrained, there are dreams in which horrid things are heard.

WHY PEOPLE SOMETIMES SEE AND HEAR THINGS THAT ARE NOT THERE

Sometimes the thing goes from bad to worse, and people begin seeing and hearing, apart from dreams, things that are not there. Everyone should know a little about this subject, because, like almost all the evils in the world, these are easy to withstand in their beginnings, but very hard to catch up with if they get a good start. We have to remember that, for us human beings, the eye and the ear are the most highly developed, the most important, the most constantly used, and therefore the most delicate of our organs of sense, and we ought always to be attentive when they begin to misbehave themselves. It is not their fault, but ours, as a rule. A little care, common-sense, and rest at this stage will put everything right.

Now, having seen how it is that the light may be interfered with on its way to the retina, we must just observe what these various materials do to the light in the way of bending it. The diagrams on page 4329 show what happens to the light, and we have only to glance at them to see how closely the eye resembles the various kinds of instruments with lenses that human beings make and use for themselves.

If we look at the course of the light in the normal eye, the short-sighted eye, and the long-sighted eye, we shall be ready to understand how spectacles affect the refraction of the light as it passes through the four materials on its way from the outside to the retina.

HOW THE RAYS OF LIGHT ARE BENT INSIDE THE EYE

All we need to do is to remember the simple rule that, when light passes through a lens, the rays are bent towards the thicker part of the lens, wherever that is. This, of course, is equally true whether the lens be inside the eye and made by the body, or whether it be a lens of glass placed directly in front of the eye.

If we look at the pictures on page 4329, we can easily find out for ourselves what kind of lens it is that would be useful for a short-sighted and what for a long-sighted person; also what kind of glasses would be required for a person whose own lenses had been taken away on account of cataract.

The way really to understand this subject—and the same is true of many subjects—is not merely to read about it or to look at pictures. It is always necessary to do something more actively oneself. We should either explain the thing to someone else, by word of mouth, or we should write down for ourselves an account of the facts, and in both cases we ought to make diagrams for ourselves as we go along.

In this way we soon discover what

parts of the thing we really understand, and what parts we do not, and very often, if we try, we can think a thing out for ourselves. To do that once is better than to read the explanation of it many times. Therefore, when this part of the subject has been read, let us take a piece of paper and a pencil, and draw for ourselves various kinds of eyes, showing the course of the rays of light in each case; then add the various kinds of lenses, and note how they will affect things; and, finally, we may draw pictures of what would happen if the glasses that we ordered were too strong, either in one direction or the other. When we have gone through all this, we may believe that we have done justice to the subject.

Everything about the eye that we have studied hitherto, from the eyelashes onwards, exists in order to serve the retina. This is one of the most wonderful things in the whole body. We are to think of it as part of the eye, but we must also—if we are really to understand it—think of it as part of the brain. We remember that it actually grew out from the brain, and, when we come to look at it, we find that it is indeed an immensely complicated structure made up chiefly of delicate nerve-fibres and nerve-cells.

A PART OF THE EYE THAT IS REALLY A PART OF THE BRAIN

There is also in it, as in every other part of the body, a certain amount of supporting tissue, the business of which is just to hold the rest together. Now, it is very interesting to discover that this supporting tissue of the retina is made of a special kind of cell which we find inside the brain itself, forming the supporting tissue there.

This alone would be a proof of what we know on many other grounds, that the retina of the eye of backboned animals is an outgrowth from the brain.

The various parts of the retina are usually described as being arranged in ten layers, but it is not necessary for us to study them all. Some of these layers consist of cells and others of nerve-fibres. It is the ninth layer from the front that we must carefully look at, because here we find the cells which are most deeply concerned with seeing. We might expect these cells to be in the very front of the retina, immediately behind the glassy jelly of the eyeball, but, in point of fact, they are not, and the light has to pass through no fewer than eight layers of various structure before it finally reaches the true vision-cells.

We must understand that these layers are extremely thin and delicate, and are only to be made out under a microscope of very high power. So what happens is not as impossible as it might sound, if we thought that these various layers were thick things and liable to disturb the light-rays. They do not do so to any degree that matters.

HOW PART OF THE BRAIN GROWS OUT AND FORMS THE RETINA

The inside of the brain is hollow and lined with cells. The brain part of the eye is formed by a hollow outgrowth from the brain, and that outgrowth becomes indented to form the retina. The vision-cells are not on the front of the retina, but close to the back of it. They are really the same as the cells that line the cavity of the brain, and when the brain sends out its little bulb on the way to make the eye, these cells line that bulb, which we can see on page 4425.

The vision-cells are of two kinds, called rods and cones from their shape. They form altogether a regular palisade of cells upon which the light strikes, and if the refracting materials in front are just right, then the light is sharply focussed just where it reaches the retina. There are far more rods than cones in the eye, but there can be no doubt that the cones are more important, as we shall see.

In every retina, there are two spots which differ from the rest of it. One is the place where the great optic nerve spreads out, so to speak, to form the retina. At that point there are no rods or cones, and so it is blind. Light falling on that point is not seen.

THE SPOT IN THE EYE THAT IS BLIND AND THE SPOT THAT SEES BEST

Close beside this blind spot is another which is called the yellow spot, and as the one spot is blind, so the other is the part of the retina where all the best seeing is really done. It is packed with cones and nothing else. That is why we say that the cones are more important than the rods. This spot is called yellow because there is a certain amount of yellow material lying in the

supporting tissue between the cells there. We do not as yet quite know the reason why it is there.

On careful study of the yellow spot, we notice that every kind of arrangement has been made in order to promote good seeing there. The eight layers that lie in front of the cones—we have seen they lie in front of the vision-cells everywhere in the retina—are at their very thinnest in this particular place. Some of them, indeed, are practically not to be found. Also, there are no large blood-vessels to get in the way of the light, but only extremely small capillaries.

All our best seeing is done by means of this spot. Whenever we wish to see a thing precisely, we turn our eyes so that the light from it shall fall upon the yellow spot, and the great business of the muscles that move the eyeballs is to move them together in such a way that the light of any particular thing that we want to see shall exactly fall on the two yellow spots, the one to be found in each eye.

THE WONDERFUL LITTLE CONES THAT HELP US TO SEE COLORS

Quite lately a great deal of interesting work has been done in studying the retina, and especially the region of the yellow spot, in various kinds of animals. Not enough has yet been done for us to go much into detail about it, but it seems quite clear that the cones are more wonderful than the rods, and can do more.

The cones appear much later than the rods in the age-long history of the progress of backboned animals, and it seems especially that the gathering together of cones into one place, without any rods at all, so as to form a yellow spot, only occurs in the highest kinds of backboned animals—namely, the birds and the mammals. There is also good reason to believe that throughout the whole retina, but especially in the neighborhood of the yellow spot, there has been a gradual evolution in the matter of seeing colors, and it is these wonderful cones that are responsible for this.

It seems to have been proved that if two things are to be seen as two, the light from them must fall upon two cones in the retina. If the two things are so small, or if they are so far away and so close to each other that the light from them only falls on one cone in the retina, they are seen as only one thing. This is the case with the double stars which are so extremely common in the sky; so much so, indeed, that every advance in the structure of the telescope shows us that more and more stars, which we had thought to be single, are really double.

WHY WE SEE BEST WHERE THE CONES OF THE EYE ARE TIGHTLY PACKED

When the eye is unaided, the light from the two stars falls only on one cone, and so to us it is only one star. Every time an astronomer resolves a star, as it is said, into two, what happens is that the telescope has spread the light out sufficiently for it to strike two cones in the retina. Evidently the fineness of vision will depend on the nearness of the cones to each other, and that means that it is greatly to our advantage to see with the part of the eye where the cones are tightly packed up against one another without any rods or anything else separating them. That, of course, is what the yellow spot does for those of the higher animals in which it has been developed.

Careful study of these facts makes it certain that for every cone in the retina there must be a special path in the optic nerve, and at least one special cell—perhaps a thousand—in the vision centre of the brain. We have used the phrase "the region of the yellow spot," because around the spot itself, where there is nothing but cones, there is an area of the retina with a good proportion of cones, but towards the edge of the retina there are scarcely any cones at all, and it is practically made up of rods.

THE LITTLE RODS OF THE EYE THAT HELP US TO SEE IN A DIM LIGHT

It has quite lately been shown that the rods have the business of helping us to see in dim light, which the cones do not notice. Ordinary daylight is so bright that the rods are exhausted by it and made useless; therefore in such light we see by the cones only. But the case is different if the rods are shielded from bright light for a little. When this happens they get time to remake the chemical substances which are necessary for their work, and then they can act. Let us see how this works

out. When we go into a dimly-lighted room, or when we go out of doors from a brightly-lighted room, upon a moonless but starlit night, we know that, at first, we see practically nothing, and then afterwards we begin to see. Until quite lately it was supposed that the reason of this was simply that we have to wait for the pupil to expand in the dimmer light so that more light may enter the eye. That is true, to be sure, but we now know that it is less than half the truth.

WHY WE CANNOT SEE WHEN WE GO SUDDENLY OUT OF A BRILLIANT LIGHT

The principal reason why we cannot see at first in such cases is that the rods of the retina are exhausted by the bright light to which they have been exposed, and the cones cannot see in a dim light. But after a few minutes the rods regain their power, as the blood is always flowing rapidly through the retina, rich in materials from which the rods can make the special substances upon which light acts when we see. So, after a little while, we begin to see again, but we see no colors. The rods are unable to distinguish one color from another; if they see at all, they see a sort of bluish grey.

Now, suppose we have gone out of doors on a starlit night, and suppose we notice a star, not too bright a star. As long as we do not look straight at it, we shall see it, but directly we look straight at it, so as to see it as well as possible, it disappears. Before we go on any farther, let us try to think out the reason for ourselves.

The reason is that, as we have already learned, when we look straight at anything we place our eyeballs so that the light shall fall directly upon the yellow spot. But there are no rods, only cones, at the yellow spot, and as the cones do not take any notice of very faint light, the star disappears.

THE DIFFERENT WAYS IN WHICH THE RODS AND THE CONES SEE LIGHT

Still more has been found out about the rods and cones within the last few years. Whatever kind of light falls on the rods, they see only the color—if it can be called a color—that we have described. This has a very interesting result if we spread out the light of the sun by means of a prism. Ordinarily, if it is nice and bright, we see a band of beautiful colors. It is the cones in our retina that enable us to do this. But if we make the band or spectrum very dim, the cones will be blind to it, and we can only see it by the rods. Its appearance now changes, because our power of seeing color has gone, and all we see is a band of dim grey light, a little shortened at the red end—or, rather, the end which was red when it was brighter and the cones could see the color. The reason why the band seems shortened is that the red rays of the spectrum do not affect the rods at all, while all the other rays produce the dim grey light we have already mentioned.

These discoveries teach us how valuable and important the cones are, and what a great advance in the history of vision it was when the cones first appeared, and especially when they were gathered together to form the yellow spot. We have said that the rods and cones form the ninth layer of the retina. Still deeper is the tenth and last layer of the retina, composed of cells which are filled with a dark brown material.

HOW THE PIGMENT-CELLS GIVE POWER TO THE RODS AND CONES

These pigment-cells, as they are called, seem to be very important and useful. For one thing, under the influence of light, we find that the pigment seems to run into the ninth layer, so as to form a little dark sheath around each rod and cone. This may be very important in enabling each of the vision-cells to act without getting muddled with the others.

Further, the pigment in the pigment-cells makes a great store of material, on which the vision-cells themselves can draw. Unless these vision-cells, the rods and cones, are properly supplied with the materials they need, and unless that supply is steadily kept up, they lose their power.

In another part of this book we have read that we can blind the eye by merely pressing on the eyeball for two or three seconds, because in doing so we retard the flow of blood—that is to say, the flow of new food materials through the retina. The colored matter inside the vision-cells is bleached by light, and when the cells are bleached they cannot see; so we know that the fresh supply must be continually kept up. If we knew more about the eight front layers

of the retina, we should very probably find that they are as interesting and important as the deepest two layers, about which we have learned a little. But we must wait for more knowledge about them.

A LAW ABOUT THE EYE THAT IS TRUE OF ALL OUR SENSES

It is a law about the action of the retina, and it is also true of the other senses, that what we feel is not in simple proportion to the intensity or strength of what excites us. We might suppose, if we did not know, that what would happen is this: add so much to the brightness of the light, and we should feel accordingly; do it again and again and again, and the result will always correspond.

But that is not the case, as we all know when we come to think of it. Add one candle to one candle, and we know the difference; add one to ten, and we scarcely know the difference; add one to fifty, and no one would notice the difference; add one voice to four voices, and we all know the difference; add one to forty, and no one could tell. In other words, the greater the outside power that excites our senses, the greater is the amount that we must add to it in order that we shall know the difference.

If this were the right place for it, it might be shown that this law is true of all our lives, and is most important every day. It means that the higher the pitch of our talking or of our writing, of our newspapers or of our feelings, the more difficult it is to increase the impression made by them. The man who is always speaking in a loud, shouting voice must shout very much louder if he is to excite our attention; but the person who always speaks in a low, soft, gentle voice has only to raise it the least little bit, and we at once give him all attention.

DO WE STOP SEEING AS SOON AS THE LIGHT GOES?

This law is true of all sensations and feelings, and of all our responses; it is probably true of every kind of living matter, and its discovery was one of the great feats of the nineteenth century. We mention it here because it can be very beautifully studied in the case of the retina, and everyone will agree how interesting it is to find that what we prove for the retina is true of all life.

The question of time is very important in regard to the action of the retina. Do we see directly the light strikes us? Do we stop seeing directly the light ceases? The answer is No to both these questions, as it is in all cases of sensation.

It takes a little time for the light to act before we see. During that time we have little doubt that the light is decomposing the special chemical substances which are lying ready for it in the vision-cells, and it is the changes produced by their decomposition that excite the fibres of the nerve of vision, and send a message to the brain.

It is probable that people vary within rather wide limits in regard to the period between the striking of the light and the sensation of its presence. We notice a similar thing in other cases, and not only in cases of sensation, for we find that there is always a period, perhaps about the hundredth of a second, between the moment at which a nerve says to a muscle "Contract" and the moment at which the muscle obeys. In this case, also, we suppose that chemical changes are going on in the muscle-cell which require a little time.

HOW THE CONES SEE THE LIGHT BEFORE THE RODS SEE IT

Quite lately it has been also proved that the different parts of the retina are not the same in this respect. The cones, in every respect of a higher type than the rods—even though they are less sensitive in dim light—are affected by light more quickly than the rods are, and it is possible to prove, by experiment carefully made, that first of all we see by the cones only, and then by the rods, too. This makes a difference to what we see, because when the rods come into action they contribute a sort of uniform grey light to everything equally; whereas, during the moment before that, we were seeing by the cones only, and they, of course, see colors.

Lastly, we find that the retina goes on seeing for a little while after the light has ceased. The duration of this after-sensation varies. If the light is moderate, probably the average length of the after-sensation is about one-fortieth of a second, but sometimes a little longer.

THE NEXT PART OF THIS IS ON PAGE 4523.

THE COUNT OF MONTE CRISTO

PART 2

CONTINUED FROM 4322

IT was not long after Edmond's escape from the Château d'If that the means by which it had been effected were discovered. But as there was no doubt about the sack containing the supposed dead body having been thrown into the sea, it was supposed that the prisoner had only exchanged the living death of his cell for the more merciful death by drowning. Edmund Dantès was "officially dead."

Some two years later the keeper of the Pont du Gard inn, not far from the town of Beaucaire, was, as usual, lounging listlessly at his door, for trade was bad and he had but little custom, when a traveler on horseback dismounted at his door and entered. The stranger proved to be a clergyman of grave and reverend aspect, and the innkeeper made rather a fuss in attending upon him. The visitor, who gave the name of the Abbé Busoni, and whose dark and penetrating eyes seemed to search into the inmost mind of the innkeeper, speedily banished the listlessness of that person, and made him all excitement by recalling the events which had occurred sixteen years before.

The name of the innkeeper was Gaspar Caderousse, which fact the abbé knew, and he astonished Caderousse by showing a minute knowledge of his earlier history. Of Edmond Dantès the innkeeper spoke with much warmth of feeling, and swore that he had ever deeply and sincerely lamented the unhappy fate of that poor young man. The abbé explained that he had been present at the death of Dantès in prison, and said that even in his dying moments the prisoner had protested he was utterly ignorant of the cause of his imprisonment.

"And so he was!" exclaimed Caderousse. "How should he have been otherwise? Ah, Monsieur l'Abbé, the poor fellow told you the truth."

"It was for that reason, then, that he besought me to clear his memory from any stain that might have fallen upon it," said the Abbé Busoni, who went on to tell, to the growing excitement of Caderousse, how a fellow-prisoner of Dantès, on being liberated, had given to Edmond a diamond of great value, with which he might have bribed the gaoler; but Edmond had not attempted to do so, and had in turn given it to the abbé, with instructions to sell it at Marseilles and to divide the money equally between five persons—the only five persons who had loved poor Dantès. These were

Mercédès, Danglars, Fernand, Caderousse, and Edmond's aged father. The abbé had heard of the death of old Dantès, and now he was told the old man had died of starvation.

The innkeeper became excited beyond measure, and recounted all he knew of the persons and events connected with Edmond Dantès, although his wife intervened and chided him for telling a stranger so much of private affairs. All that the intelligence of the poor Abbé Faria had been able to guess at from Edmond's own story was confirmed and made plain by the statements of Caderousse, who proved to his visitor that Danglars and Fernand had been the deadly enemies of Edmond.

HOW ALL THE ENEMIES OF EDMOND DANTÈS HAD PROSPERED

But whereas Danglars had prospered and was now rolling in wealth, and Fernand also had risen to great things, being now the Count d'Morcerf, Monsieur Morrel, who had been a real friend to Edmond, and ever an honest man, was in dire extremities, as his great shipping business had met with a series of misfortunes.

The wicked had flourished, and the honest had suffered. Danglars' fortune had been built up by fraud. Fernand, now a distinguished soldier, had made his success when, as a French soldier in the service of the Greeks, he betrayed the Albanian patriot, Ali Pasha, to the Turks, thus getting a traitor's reward from the enemy, as well as stealing the fortune of his victim. The Countess d'Morcerf was the Mercédès who was to have married Edmond, and who had, indeed, truly mourned her lost lover until all hope was lost.

"And M. de Villefort?" asked the abbé. "Do you not know what became of him, and the share he had in Edmond's misfortunes?"

"No; I only know that, some time after having arrested him, he married Mademoiselle de Saint-Méran, and soon after left Marseilles; no doubt but he has been as lucky as the rest; no doubt he is as rich as Danglars, as high in station as Fernand. I only have remained poor, wretched, and forgotten."

THE DIAMOND FOR WHICH CADEROUSSE BECAME A MURDERER

"You are mistaken, my friend," replied the abbé. "God may seem sometimes to forget for a time, while His justice reposes, but there always comes a moment when He remembers—and behold a proof!" As he spoke, the abbé took the diamond from his pocket, and, giving it to Caderousse, said: "Here, my friend, take this diamond; it is yours."

"What! for me only?" cried Caderousse. "Ah, sir, do not jest with me!"

"This diamond was to have been shared among his friends. Edmond has one friend only, and thus it cannot be divided. Take the diamond, then, and sell it; it is worth ten thousand dollars."

But, alas! this good fortune was the undoing of Caderousse, who was a man of weak and undecided character, and was worthy to be called neither a friend nor an enemy of Dantès. He and his wife, greatly agitated over their new possession, invited a diamond dealer to the lonely Pont du Gard inn to examine and purchase the diamond which the mysterious abbé had given them. The lowest instincts of both husband and wife were inflamed, not only by the sight of the precious stone, but by the thought that they might keep the gem and steal the money from the dealer who had come to buy it. Thus it was that Caderousse became a murderer, and was condemned to the galleys at Toulon.

THE STRANGE COUNT OF MONTE CRISTO COMES TO PARIS

The years passed by, and still all the wicked people concerned in our story seemed to prosper. It was about eight years after the tragedy at Caderousse's inn that a certain Count of Monte Cristo became a great figure in the life of Paris. His name awakened thoughts of romance and dazzling wealth in the minds of all, for he was the hero of a hundred strange stories, more suggestive of the time of the "Arabian Nights" than of the first half of the nineteenth century. It was Albert, the son of the Count d'Morcerf, who first introduced the Count of Monte Cristo to the high society of Paris. They had become acquainted at Rome, where Monte Cristo had been able to render a great service to the Viscount Albert d'Morcerf, and his friend, the Baron Franz d'Epinay.

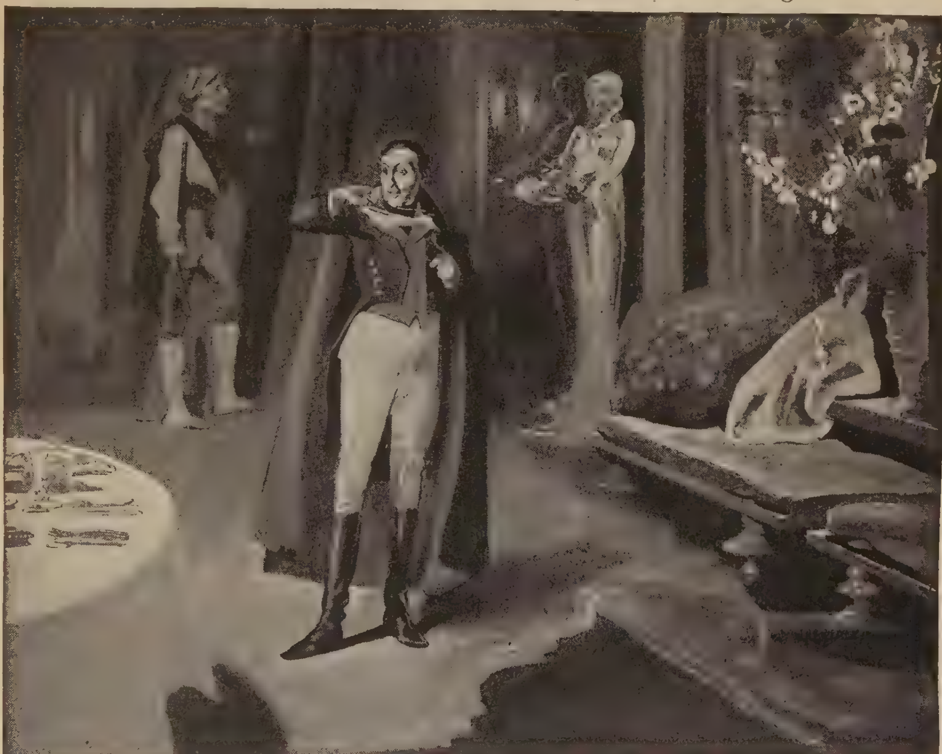
This Monte Cristo was a tall man, with a lithe, agile figure, capable of the greatest exertion. While his face was pale to ghastliness, his eyes were large, and gleamed at times with an uncanny

light. His hair was black as jet, making the deadly paleness of his countenance the more pronounced. Baron Franz was convinced that he had met this strange man before. He had landed on one occasion on the island of Monte Cristo, and there he had encountered a band of smugglers, whose chief invited him to dinner. After he had been blindfolded, he was led into a cave, which was fitted up with the most marvelous luxury; and there he was entertained at a wonderful banquet. This was concluded by his host inviting him to taste some greenish paste contained in a beautiful silver vessel. It was the famous "hashish." After Baron Franz had tasted it, he sank into gorgeous dreams and visions, and when he awoke again, it was to find himself on the seashore, and the most diligent searching never brought him again to the secret entrance of this magic cave. He believed that the chief and Monte Cristo were the same.

All sorts of stories were afloat in Paris as to the history of this Count of Monte Cristo. When he went to the Opera, he was accompanied by a beautiful Greek girl, said to be a princess, named Haidée, whose guardian he was. A well-known lady declared he was a vampire! But the air of mystery about him was just what Paris liked, and the fact that he had unlimited credit at the bank controlled by the Baron Danglars was enough to make him talked about, and to open all doors to him.

There were others than the Baron Franz who thought they had met him before. When he was presented to the Countess d'Morcerf, that lady showed such agitation in meeting him that her son was seriously alarmed. But nothing ruffled Monte Cristo. Calmness and deliberation marked all his movements; in some respects he was more like a machine than a human being. If he made an appointment for nine o'clock, he entered when the clock was striking the fifth of the nine hours. Everything he said he would do was done precisely. And now he began to carry through as certainly and relentlessly as fate the schemes which he had studied in secret.

There was a house of Auteuil, a suburb of Paris, which was to be let. One day,



THE BARON HAD BEEN LED BLINDFOLDED INTO A CAVE OF MARVELOUS LUXURY

with his steward, Bertuccio, Monte Cristo drove out to see it, as he had arranged to purchase it.

"Tell them to stop at Rue de la Fontaine, No. 28," said the count, fixing his eyes on the steward, to whom he gave this order. Bertuccio's forehead showed great beads of perspiration when he heard the number of the street mentioned, but he gave the order.

THE STEWARD WHO BELIEVED HIMSELF TO BE A MURDERER

Bertuccio accompanied his master from room to room, showing great uneasiness when they went down a stair that led to the garden; for Monte Cristo seemed to know all that had happened in the house. When his master asked him if he supposed anything had been buried beneath a tree to which he had led the steward, Bertuccio had finally to confess all he knew, saying that the Abbé Busoni was the only one who already knew the story of his crime. Villefort had callously refused justice to Bertuccio many years before, and he had sworn to revenge himself upon him. He had traced him to this house, and in this garden he struck him down in the very instant when Villefort had been preparing to bury a little infant that was still alive. That child Bertuccio had reared, and given him the name of Benedetto; but he had grown to be a scoundrel of the worst type, and was now a criminal outcast.

After this confession, Bertuccio said his master could do with him as he wished, but Monte Cristo set his mind at rest by telling him he had not struck true—that Villefort still lived.

MONTE CRISTO LAYS A DEEP PLOT TO CONFOUND ONE OF HIS ENEMIES

There was a deep-laid scheme in the purchase of this house at Auteuil. The Count of Monte Cristo arranged a dinner-party there. Among those invited were the Baron and Baroness Danglars and M. de Villefort, who, as procureur du roi, or public prosecutor, had long enjoyed power.

The repast was magnificent; Monte Cristo had endeavored completely to overturn the Parisian ideas, and to feed the curiosity as much as the appetite of his guests. It was a veritable fairy banquet, and not only impressed his guests with the enormous wealth of their host, but with his exhaustless ingenuity in producing surprises for them. After dinner Monte Cristo led the conversation on to the subject of the tragedies of old houses. If that house could but tell what had happened in it years ago, how interesting and terrible it might be! And so, step by step, he took his party from room to room, and down the stairs into the garden, telling them the strange story of a child that had been buried there, which the gloomy old house seemed to have told to him. Certain of the guests were painfully excited by the count's rehearsal, as he had meant them to be, and M. de Villefort had to confess to himself that he was in the hands of Fate personified by this terrible and mysterious man known as the Count of Monte Cristo.

Villefort had a daughter by his first wife, for he had married a second time. Her name was Valentine, and at the command of her father, but not by her own wish, she was engaged to be married to the Baron Franz d'Epinay. This beautiful girl was in love with a gallant young military officer named Maximilian Morrel, son of the Marseilles shipowner. But neither of them had dared to avow their affection for each other to Valentine's father.

THE MAN WHO SIGNED HIMSELF "SINDBAD THE SAILOR"

It was Franz, however, who told Maximilian that among the stories of Monte Cristo it was said he often gave great gifts of money to help deserving people, and signed himself "Sindbad the Sailor." This was great news for Maximilian, for his father had been saved from ruin by a generous gift from an unknown benefactor who had signed himself Sindbad the Sailor. He hastened at once to the house of Monte Cristo to thank him for his generosity, and from that day became a devoted admirer of the strange man. His inmost thoughts he told to him, and all the story of his hopeless love for Valentine.

Meanwhile the tide of fortune seemed to have turned with Baron Danglars. His business had suffered many losses, but his greatest loss of all was due to some false news about the price of stocks and shares which had been telegraphed to Paris by means which Monte Cristo could have explained. The

baron's daughter was engaged to Albert d'Morcerf, but the Count d'Morcerf had now come under a cloud, for his betrayal of Ali Pasha had been made public; and perhaps the Count of Monte Cristo could have told how the truth had come out at last. So the baron did not hesitate to break the engagement and to accept as the suitor for his daughter a dashing young man known as Count Cavalcanti, who had been introduced to Paris by Monte Cristo, but concerning whose antecedents nothing at all seemed to be known.

THE DOWNFALL OF THE FIRST OF DANTÈS' ENEMIES

The Count d'Morcerf was tried for his betrayal of Ali, and seemed likely to be acquitted, when a veiled woman was brought to the place of trial and testified before the committee that she was the daughter of Ali Pasha, and that Morcerf had not only betrayed her father to the Turks, but had sold her and her mother into slavery. The veiled woman was Haidée, the ward of Monte Cristo. The Count d'Morcerf was now a ruined man, and when his son Albert discovered the part that Monte Cristo had played, he publicly insulted the count at the Opera, and had the immediate satisfaction of being granted an opportunity to revenge himself in a duel, which was to take place the next morning, with pistols, in the Bois de Vincennes. But that night the Countess d'Morcerf appealed to Monte Cristo not to kill her son. In the course of her tearful interview Mercédès learned from the lips of Edmond Dantès himself—for she had never doubted that Monte Cristo was he—how her husband had betrayed him, and the infamy of Danglars and Villefort as well.

"But what you ask of me you shall have," said he. "Your son shall live."

MERCÉDÈS PLEADS WITH DANTÈS TO SPARE THE LIFE OF HER SON

"Oh," said she, seizing the count's hand and raising it to her lips—"oh, thank you, thank you, Edmond! Now, you are exactly what I dreamed you were, such as I have always loved you. Oh, now I may say so!"

"So much the better," replied Monte Cristo, "as that poor Edmond will not have long to be loved by you. Death is about to return to the tomb, the phantom to retire in darkness."

"What do you say, Edmond?"

"I say, since you command me, Mercédès, I must die."

"Die! and who told you so? Who talks of dying? Whence have you these ideas of death?"

"You do not suppose that, publicly outraged in the face of a whole theatre, in the presence of your friends and those of your son—challenged by a boy, who will glory in my pardon as in a victory—you do not suppose I can for one moment wish to live. What I most loved after you, Mercédès, was myself, my dignity, and that strength which rendered me superior to other men; that strength was my life. With one word you have crushed it, and I die."

But the duel was averted, as Albert publicly apologized to the count, and, furious that he had not been avenged by his son, Morcerf rushed to the house of Monte Cristo.

"I came to tell you," said Morcerf, "that as the young people of the present day will not fight, it remains for us to do it."

"So much the better," said Monte Cristo. "Are you prepared?"

DANTÈS' HOUR OF VENGEANCE ON HIS FIRST BETRAYER, FERNAND

"Yes, sir; and the absence of witnesses is of no account, as we know each other so little."

"Truly they are unnecessary," said Monte Cristo, "but for the reason that we know each other well. Are you not the soldier Fernand who deserted on the eve of Waterloo? Are you not the Lieutenant Fernand who served as guide and spy to the French army in Spain? Are you not the Captain Fernand who betrayed, sold, and murdered his benefactor, Ali? And have not all these Fernands, united, made the Lieutenant-General Count d'Morcerf, peer of France?"

"Oh," cried the general, "wretch, to reproach me with my shame. Tell me your real name that I may pronounce it when I plunge my sword through your heart."

At this Monte Cristo, bounding to a dressing-room near his bedroom, quickly pulled off his coat and waistcoat and his cravat, and, donning a sailor's jacket and hat, was back in an instant.

Morcerf, when he saw him again, felt his teeth chatter and his legs sink under him, so that he had to support himself by a table.

"Fernand," cried Monte Cristo, "of my hundred names I need only tell you one to overwhelm you. But you guess it now, do you not?—or, rather, you remember it? For, notwithstanding all my sorrows and my tortures, I show you to-day a face which the happiness of revenge makes young again—a face you must often have seen in your dreams since your marriage with my betrothed!"

Gazing for a moment in terror at this man who seemed to have risen from the dead to avenge his wrongs, Morcerf turned, seeking the wall to support him, glided along close to it until he reached the door, by which he went out backwards, uttering the one distressing cry—"Edmond Dantès!"

Events marched rapidly now, and Paris had scarcely ceased talking of the suicide of the Count d'Morcerf, when Cavalcanti was arrested for the murder of a fellow-convict named Caderousse, who had been blackmailing him. Caderousse had identified Cavalcanti as a former galley-slave named Benedetto.

THE FALL OF BARON DANGLARS AND HIS FLIGHT FROM FRANCE

It now came out that both Benedetto and Caderousse had been liberated by a mysterious Englishman who had spent large sums of money to enable them to escape. The Englishman's name was Lord Wilmore, but he and the Abbé Busoni and the Count of Monte Cristo were the same person, though the police knew it not!

Danglars fled from France, his great business in ruin, and with him he took a large sum of money belonging to the Paris hospitals.

In the household of Villefort, Monte Cristo had done nothing to bring vengeance on that evil man. He had seen from the first that Villefort's second wife took great interest in chemistry, because she was studying the art of poisoning, and he felt that revenge was already at work here. There had already been two mysterious deaths in the Villefort family, and now the beautiful Valentine, according to the doctor, seemed to be suffering from the early effects of some slow poison.

Maximilian Morrel, in despair of Valentine's life, rushed to Monte Cristo for his advice and assistance.

"Must I let one of the accursed race escape?" Monte Cristo asked himself, but decided, for Maximilian's sake, that he would save Valentine.

VENGEANCE AT WORK IN THE HOME OF DE VILLEFORT

Monte Cristo had bought the house adjoining that of Villefort, and, clearing out the tenants, had engaged workmen to make repairs and alterations. He had made them remove so much of the old wall between the two houses that it was a simple matter for him to take out the remaining stones and pass into a large cupboard in Valentine's room. Here the count watched while Valentine was asleep, and saw Madame de Villefort creep into the room and substitute for the medicine in Valentine's glass a dose of poison.

He then entered the room as Valentine awoke, but before she could cry out in amazement he made her keep silence, and told what he had seen. He threw half the draught into the fireplace, leaving the rest in the glass, and gave Valentine one of his famous pellets of hashish, which made her sink into a death-like sleep. He then retired to watch again, and in a little time Madame de Villefort returned.

Thinking that Valentine had drunk half of the poison, she threw the rest away, but Monte Cristo knew the poison, and, having brought some of the same with him, went in again and half filled the glass.

Next morning the doctor declared that Valentine was dead. In the glass he discovered poison, and as the same poison was found in madame's laboratory, there was no doubt of her guilt. She admitted all, and confessed that her object had been to make her own son the sole heir to Villefort's fortune.

THE TRAGIC FATE OF THE MAN WHO SENT DANTÈS TO THE CHATEAU D'IF

Madame de Villefort fell at her husband's feet. He addressed her with passionate words of reproach as he turned to leave her presence.

"Think of it, madame," he said, "if on my return justice has not been satisfied, I will denounce you with my own mouth, and arrest you with my own hands! I am going to the court to pronounce sentence of death on a

murderer. If I find you alive on my return, you shall sleep to-night in gaol."

Madame sighed, her nerves gave way, and she sank on the carpet.

"Farewell, madame, farewell!" said her husband, as he left the room.

But Villefort little knew at the moment he spoke these burning words to the woman who was his wife that he himself was not going out to condemn a fellow-sinner, but to be himself condemned. For the man to whom he referred as a murderer was the so-called Count Cavalcanti, really Benedetto, and the night before the criminal had had a long interview with Bertuccio, who had disclosed to the prisoner the secret of his birth.

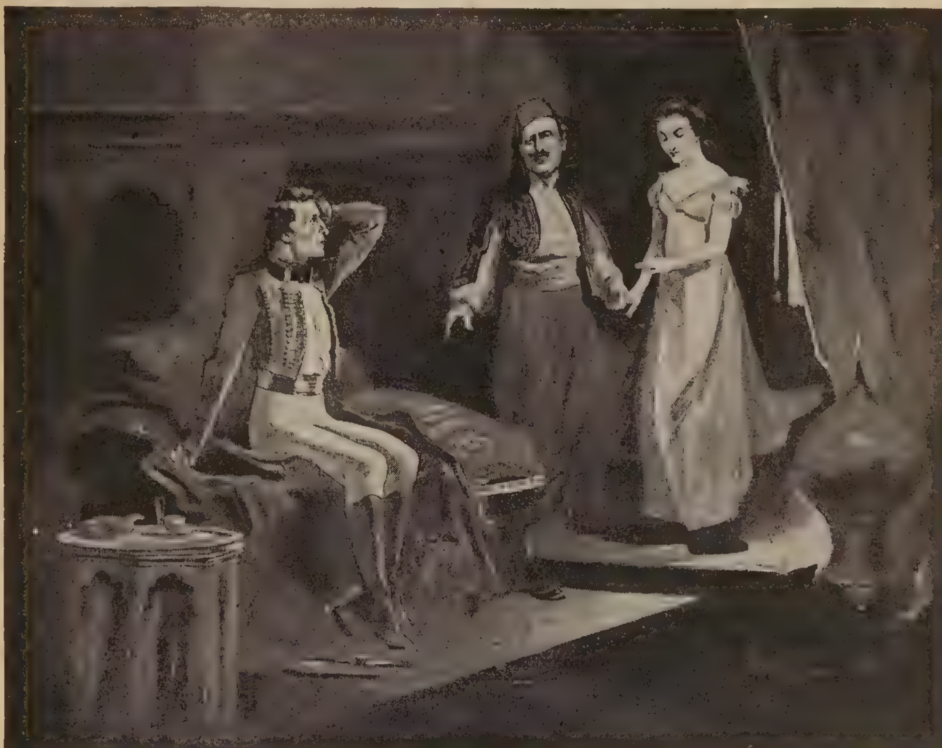
Benedetto appeared in court dressed in the most elegant manner and showing no sign of anxiety. Villefort had never been more eloquent than he was in describing to the court the character of the prisoner's crime. When the president of the court asked Benedetto his age, he replied:

"I am twenty-one years old; or, rather, I shall be in a few days, as I was born on the night of the 27th of September, 1817." M. de Villefort who was busy taking down some notes, raised his head on hearing the date.

"Where were you born?" continued the president.

"At Auteuil, near Paris." M. de Villefort a second time raised his head, looked at Benedetto as if he had been gazing at the head of Medusa, and became livid. As for Benedetto, he gracefully wiped his lips with a fine cambric pocket-handkerchief.

"Your profession?"



IT WAS NO DREAM, FOR VALENTINE STOOD THERE, RESCUED FROM DEATH BY MONTE CRISTO

"First I was a forger," answered Andrea, as calmly as possible; "then I became a thief; and lately have become an assassin."

A murmur, or, rather, a storm of indignation, burst from all parts of the assembly. The judges themselves appeared stupefied; and the jury manifested tokens of disgust for a stoicism so unexpected from a fashionable man. M. de Villefort pressed his hand upon his brow, which was now red and burning; then he suddenly rose, and looked around as though he had lost his senses.

The president next asked the accused to state his name, to which he politely replied that, while he could not tell his own name, he knew his father's. His father, he declared, was Villefort, the public prosecutor! This statement made a great commotion in the court, and all eyes were on Villefort, while Benedetto continued to answer the questions of the president, and proved that he was the child whom Villefort would have buried alive that night when Bertuccio thought he had revenged himself upon Villefort in the garden at the house at 28, Rue de la Fontaine, Auteuil. But the public prosecutor himself confirmed the prisoner's story by admitting his guilt, and declaring that he held himself at the disposal of the public prosecutor who would succeed him.

As he spoke these words with a hoarse, choking voice, he staggered towards the door, and so from the court, which was stricken dumb with amazement for the moment. The president adjourned the sitting, and all fell to discussing the strange turn of events.

VENGEANCE, SLOW BUT TERRIBLE, OVERTAKES THE ARCH-VILLAIN OF THE STORY

When Villefort arrived at his own house he found everything in confusion. Making his way to his wife's apartments, he had the horror of meeting her while she still lived, but just at the very instant when the poison she had taken did its work. His thoughts were now for his son, Edward, and after a search he found the child asleep, as he thought, upon a sofa. But as he lifted him up a folded paper fell from the child's breast, and, thunder-struck, his father dropped on his knees and let the body of the boy rest on the floor beside his mother. Villefort picked up the paper and read in his wife's writing:

"You know that I was a good mother, since it was for my son's sake I became criminal. A good mother cannot depart without her son."

This was more than the brain of man could endure, and Villefort turned from the tragic scene a raving madman, rushed wildly to the garden, and began to dig with a spade.

It was not long after this that the Baron Danglars was cleverly entrapped by some brigands in the catacombs of St. Sebastian, some little way outside Rome, and there, instead of being held to ransom, he was made to pay such fabulous sums for food and lodging that the money he had stolen from the charities on running away from Paris was very quickly transferred to the pockets of the brigands. But at length Monte Cristo appeared to the prisoner, and, after accusing him of his crimes, told him that he was in the hands of Edmond Dantès. At this Danglars uttered a cry and fell prostrate.

THE WAY THAT MONTE CRISTO PUNISHED BARON DANGLARS

"Rise," said the count. "Your life is safe; the same good fortune has not happened to your accomplices; one is mad, the other dead. Keep the 50,000 francs you have left, I give them to you. The 5,000,000 you stole from the hospitals has been restored by an unknown hand. And now eat and drink, and when you are satisfied you shall be free."

Danglars stayed that night with the brigands, but in the morning he found himself lying near a stream. Being thirsty he dragged himself towards it, and as he stooped to drink he perceived that his hair had become quite white.

The vengeance of Edmond Dantès, so long delayed, so carefully and laboriously planned, was now complete, and it only remained for him to perform the last of his marvels, at the same time giving proof of his boundless generosity. Valentine de Villefort had been buried, and Maximilian was in despair; but Monte Cristo urged the young man to have patience and hope, and as his father had been a father to Edmond Dantès, so would Dantès be a father to him.

MONTE CRISTO MAKES A STRANGE BARGAIN WITH MAXIMILIAN MORREL

It seemed a strange thing to ask a lover whose sweetheart had been placed within the tomb to have hope and to come to Monte Cristo in one year. But this was the bargain they made.

Mercédès and her son had meanwhile given to charities the ill-gotten fortune left by Fernand. Monte Cristo had bought the house his father lived in at Marseilles, and in the garden there he had buried the dowry he had originally saved up when he was to be married to Mercédès. This house and the buried dowry he now gave to her, and there the beautiful countess spent her days in the simplest way, her son helping her also from his pay as an army officer.

When the year had passed during which Monte Cristo had bidden Maximilian Morrel to hope, the two met at Marseilles, and then went by yacht to the island of Monte Cristo. Seated in the mysterious cave, the count asked him whether he was still of the same mind, and he replied that nothing had touched his grief at the loss of Valentine. He was still resolved to die. It was yet three hours from the time until which Maximilian had promised to remain alive. The two friends talked much about the joys and sorrows of life as they sat there in that strange room, where the statues that stood around the banqueting-table had silver baskets always full of fruit, no matter how much was taken away. At last the count gave Maximilian a spoonful of a mysterious substance which was supposed to effect a painless death.

HOW TWO LOVERS WERE STRANGELY UNITED, THANKS TO MONTE CRISTO

Just as the young man seemed to be sinking softly into unconsciousness he saw Monte Cristo open a door leading to another room, and on the threshold, illumined by a strong light, stood a beautiful young woman, the picture of the beloved Valentine. This was no dream, and Morrel was not dying. It was indeed Valentine, who, when she was supposed to have died, was only in a trance, induced by the pellet given to her by the count. Monte Cristo had rescued her from the tomb, revived her, and for these twelve months, while the love of Morrel had stood its test, Valentine had been the companion of Haidée. As the truth of his new-found happiness dawned upon the faithful young man, Monte Cristo had some real reward for the service he had rendered the lovers; and when he learned that he was himself as much beloved by Haidée as Maximilian was by Valentine, it seemed to this strange and wonderful man that life might still have a greater happiness for him than the fulfilment of his vengeance.

Next morning, when Valentine and Maximilian met and went out to the beach, Jacopo, the captain of Monte Cristo's yacht, had a letter for them, which Morrel opened and read.

"MY DEAR MAXIMILIAN,

"There is a felucca for you at anchor. Jacopo will conduct you to Leghorn, where M. Noirtier awaits his granddaughter, whom he wishes to bless before you lead her to the altar. All that is in this grotto, my friend, my house in the Champs Elysées, and my château at Tréport, are the marriage gifts bestowed by Edmond Dantès upon the son of his old master, Morrel. Mademoiselle de Villefort will share them with you; for I entreat her to give to the poor the immense fortune reverting to her from her father, now a madman, and her brother, who died last September with his mother. Tell the angel who will watch over your future destiny, Morrel, to pray sometimes for a man who, like Satan, thought himself, for an instant, equal to God, but who now acknowledges, with Christian humility, that God alone possesses supreme power and infinite wisdom. Perhaps those prayers may soften the remorse he feels in his heart. As for you, Morrel, this is the secret of my conduct towards you. There is neither happiness nor misery in the world; there is only the comparison of one state with another, nothing more. He who has felt the deepest grief is best able to experience supreme happiness. We must have felt what it is to die, Morrel, that we may appreciate the enjoyments of life.

"Live, then, and be happy, beloved children of my heart! And never forget that, until the day when God will deign to reveal the future to man, human wisdom is contained in these two words—*wait* and *hope*.

"Your friend,

"EDMOND DANTÈS,

"Count de Monte-Cristo."

THE LAST WORDS OF MONTE CRISTO AND THE LAST WE HEAR OF HIM

"But where is the count?" asked Morrel eagerly. Jacopo pointed towards the horizon where a white sail was visible.

"And where is Haidée?" asked Valentine. Jacopo still pointed towards the sail.

"Gone!" said Morrel. "Adieu, my friend. Who can say whether we shall ever meet them again?" His eyes were filled with tears.

"My friend," said Valentine, "has not the count just told us that all human wisdom is contained in these two words —*wait* and *hope*?"

THE NEXT FAMOUS BOOKS ARE ON PAGE 4639.

THE FIRST REAL TELEGRAPH EVER MADE

Although many men had dreamed of sending messages across long distances by electricity, it was an Englishman, Sir Francis Ronalds, who was the inventor of the first real electric telegraph. Here we see the arrangement by which he erected eight miles of wire in the garden of his house at Hammersmith, the house that was afterwards occupied by the poet and reformer, William Morris. Ronalds offered his invention to the British Admiralty, but it was rejected on the ground that telegraphs were unnecessary.

THE MAKERS OF TELEGRAPHS AND TELEPHONES

CONTINUED FROM 4368

NO one can tell us in a sentence who made the telegraphs and telephones. There have been too many men concerned in these inventions for the story to be given in few words. The savage who lights a fire, so that the smoke may be seen from afar by his comrades is using a telegraph such as all men used once upon a time. The army signaler who waves two flags, about in a particular manner is telegraphing. The man who uses the heliograph—a mirror which reflects the rays of the sun—is using another old-time method of telegraphing signals.

Every boy and girl who has used a piece of looking-glass to reflect the rays of the sun into dark corners has been making use of the heliograph without thinking of the wonder that he or she was performing. Boys and girls call the dancing light which they make with their little mirrors a Jack-o-Dandy. It is worth remembering, when we use them, that this sort of thing, on a much greater scale, of course, used to serve as a telegraph apparatus for the whole of Algeria nearly a thousand years ago. By an arrangement of large mirrors they used to telegraph with sun-rays from one end of the country to the other. And to-day the people in California use the same contrivance, and with their mirrors telegraph, by the aid of the sun, nearly two hundred miles. We do not know who first thought of using a mirror and the sunshine to telegraph. Many of the most wonderful things in the world were done by men whose names remain unknown.

We do not know for certain the name of the man who first suggested the electric telegraph, which everybody really means now when he talks about the telegraph. Of course, the way of working it is very different from the working of any other telegraph; but we can see that the same forces of Nature serve to carry the sight of the savage's camp-fire smoke and the reflected rays of the sun and the mysterious electric message which flits with the speed of light along the telegraph wires, or without wires at all, simply through the open air.

The way for the telegraph was being prepared, piece by piece, by those clever, painstaking men who found out about electricity for us in the manner described on page 2161. They never dreamed to what they were leading. They loved knowledge for its own sake, and little thought of the tremendous gift that they were

giving to the world. If we would find the very cradle of the electric telegraph, we ought to seek it in the glass tube from which the jolly Bluecoat boy, Stephen Gray, about whom we read on page 2163, sent a current of electricity for a distance of nearly 900 feet along a little cable. Sir William Watson, as we read on page 2164, did better than this by sending the current from one Leyden jar to another placed two miles away.

THE UNKNOWN MAN WHO WAS THE REAL FATHER OF THE TELEGRAPH

This was interesting, and was wonderful new learning for the scientists; but it did not seem to lead anywhere in particular until, in 1753, an unknown man wrote to a paper in Scotland suggesting that we might use these electric currents for sending *messages* to a distance.

He had two schemes. One was to have a wire for each letter of the alphabet, and for a current to be sent along the wire A when that letter was meant. The current would agitate a piece of paper at the receiving end of the wire, and on that piece of paper would be printed the letter A. Or the current might act upon an automatic inker which would print a sign standing for A, or whatever the letter might be. His second proposal was the better one. That was to have only one wire, and for a light ball at the end to be so agitated by the electric current that it should strike a bell and give signals which would stand for letters, and be read off and written down by the person at the receiving end of the telegraph wire.

We do not know who that man was, though some people believe him to have been a Greenock doctor named Charles Morrison. He must have been a man with a very clear mind, for, as we know, the method of giving the electric signals that is in general use everywhere to-day is not so very different from the second suggestion that he made.

THE MANY CLEVER MEN WHO PREPARED THE WAY FOR THE TELEGRAPH

But, no matter what had been proposed then, they had not the means to carry it out. They could not produce electricity in sufficient force to make a good telegraph. The discoveries of Volta, giving the world the Voltaic pile, were seized upon as a royal road to success in the new field. Nearly all the men of this period, of whom we read on pages 2161 to 2170, did something to help by their discoveries, not deliberately, but by placing their knowledge at the disposal of others who were fixing their thoughts on telegraphy. The effects of electricity upon water and upon the salts of minerals, far away as they seem from an ordinary telegram, all had their share in helping towards the end.

Those great men, Humphry Davy, the chemist's apprentice, and Michael Faraday, whom Davy helped to success, were among those who did much for telegraphy at this stage by finding out some of the greatest secrets of electricity and its effects. Oersted, as we read on page 2167, found that an electric current turns the magnetic needle.

All the world might have known this and have been no better off had not Faraday, the poor blacksmith's son, worked on and found out that the magnet will electrify wire through which no current is passing. This led him to show us that we can perform the wonders described on page 2168.

THE FAMOUS DISCOVERY THAT MADE THE ELECTRIC TELEGRAPH POSSIBLE

A great power was thus placed at the command of men. They could create as much electricity as they needed, and could use it as they wanted, without fear of its escaping or of the supply running out, as was bound to happen with the Leyden jar or the Voltaic pile.

Still, the first real telegraph did not come from Faraday's discovery. It was one which cost its maker a great deal of care and anxiety and money—and disappointment. The inventor was a man named Ronalds, who afterwards became Sir Francis Ronalds. He was the son of a London merchant, and was born in 1788, just when attention was being turned by so many people to the problem of electricity.

When he grew up he gave all his thought to the study, and succeeded in making a telegraph system in his own garden at Hammersmith with wires eight miles long. He made the wires run round the garden many times, so that all this length of wire might be employed. Then he had an arrangement for creating electricity by friction, and he could send a current right through the whole length of his wires. At each end he had

THE MEN WHO INVENTED TELEGRAPHS

S. F. B. Morse, an American artist, invented the well-known Morse system of telegraphy, which has been adopted in almost every part of the world. The first message, "What hath God wrought?" was sent from Washington to Baltimore in 1844. Morse, who is seen in this picture making his experiments, lived for years without recognition, but later he received honors and rewards from almost every European Government.

Sir Charles Wheatstone, who did for England what S. F. B. Morse did for America, had an intense love for science from his childhood. He worked in the shop of a music-seller, but found time to study physics, and after many experiments he invented, with Sir William Cooke, the instrument from which has grown the telegraph system in use throughout the British Isles. Here Sir Charles Wheatstone is working his instrument.

a dial which, acted upon by the current, caused a letter to appear before an opening in the dial. This arrangement was controlled by the action of a pair of pith balls, through which the current passed. Having perfected his machine, Ronalds offered it to the British Government, which at that time had only wooden signals worked by hand for their telegraphs.

A BRITISH GOVERNMENT THAT THOUGHT THE TELEGRAPH UNNECESSARY

But they would not hear of an electric telegraph. "Telegraphs are wholly unnecessary, and no other than the one in use will be employed," they answered. Governments are sometimes very stupid. Ronalds gave up telegraphy, and the field was left to others, and, being a cheerful, unselfish man, he rejoiced that others should succeed where he failed. He saw the telegraph in operation all over the British Isles before he died. The success of the plan is due to Sir Charles Wheatstone, who was born in 1802, and died, two years after Ronalds, in 1875; and to Sir William Fothergill Cooke, who was born in 1806 and died in 1879.

It is strange that these two men should have come together to do this great work. Cooke was, for many years, in the Army in India, and became a doctor. Wheatstone was the son of a Gloucester musical instrument maker, and was sent to London to the shop of an uncle who was a music-seller.

Both loved science, and were specially attracted to the study of electricity. Wheatstone was able to give his time more and more to this pursuit. He became noted for his writings on various scientific subjects, and was appointed a professor at King's College, where he conducted important experiments. Among these was a test of the speed at which an electric current travels along a wire.

HOW WHEATSTONE AND COOKE MADE THE FIRST PRACTICAL TELEGRAPH

Cooke first heard of electricity in connection with the telegraph while he was studying medicine abroad. His quick mind soon saw that there were great possibilities in it; so, giving himself up to the work, he returned to England, and entered into partnership with Wheatstone. The result was excellent. Cooke was a good business man, Wheatstone was a genius. Together they made the first practical telegraph ever used in England. It was first used in 1838, on the London and Blackwall Railway. Like nearly all new things, it was not perfect. It had five lines of wire, which, of course, made it very expensive. In the following year the number of lines was reduced to two, but even this was too costly, so in 1845 the partners brought out a telegraph for which only one wire was required. It was practically the same instrument as that used to-day for small offices in the British Isles.

S. F. B. MORSE, THE PAINTER, WHO INVENTED THE TELEGRAPH FOR AMERICA

Other scientists in England, Germany, France, and America were working at the same time as Wheatstone in the endeavor to make a telegraph instrument that would do practical work. Among them, the greatest of all was Samuel Finley Breese Morse, the American to whom we owe not only the famous Morse telegraph system, but the Morse alphabet, which is used the world over in both electric telegraphy and in signaling. You will find this alphabet on page 3577. Morse was born in Charlestown, Massachusetts, in the year 1791, when Washington was president, and the French Revolution was growing toward fury. His father was a congregational minister, who was noted for the geographies that he wrote, rather than for his sermons. Samuel Morse grew up in an atmosphere of learning, and when he was nineteen graduated from Yale. He then became an artist. He was the first president of the National Academy in New York, and went to Europe twice to study. It was when he was on his voyage back the second time that the incident occurred which turned his attention solely to electricity, in which he had always been interested. The story told is that one day on ship-board, when he was discussing electricity and the electro-magnet with other passengers, the idea of his telegraph apparatus came to him. Voyages were slow in those days of sailing ships, and before he reached New York, he had worked out the first rough drawings of the instrument which was the forerunner of those now used in most of the countries of the world. He was poor and had to do without many things so that he might use the money for

experiments. But he persevered, and by 1836 he had succeeded in making an instrument that would work. Next year he produced a better instrument, and showed it to some friends. This was patented the same year—1837—but it was a long time before Congress would give any help toward building a telegraph line. This they did in 1843. The first telegraph line was built in 1844 from Washington to Baltimore, and Morse sent over it the message "What hath God wrought?"

About ten years afterward a man named Jackson claimed that he was the original inventor of the telegraph. He went to law to prove it, but Morse was able to bring evidence to show that he was the real inventor, and that there was no truth in Jackson's statement.

Morse lived until 1872, and saw the wonderful transformation in the business of the world with which his invention had so much to do. The telegraph was quickly adopted by most of the European countries, and though they paid its inventor nothing at the time, they afterward combined to present him with a large sum.

And now we shall go back to think about another American, who was among those who helped to make the Morse telegraph possible. You remember that we read on page 2169 how William Sturgeon made the first electro-magnet. This was improved upon by Joseph Henry, who insulated the copper wire of the magnet by covering it with silk thread. Instead of using one wire coiled round the magnet, as Sturgeon did, he made a close covering for the soft iron core by winding round it several of his silk-covered wires.

JOSEPH HENRY AND THE ELECTRO-MAGNET

Joseph Henry was born in Albany, 1797, and attended the Academy there. As he meant to be a doctor, he commenced to study chemistry, and from that his interest in electricity began. In 1826, he was made professor of mathematics in his old school, and shortly after began his experiments with the electro-magnet. He made many experiments in electricity which all helped toward gaining knowledge of this wonderful subject.

He was one of the first of the noted scientists in the United States, and was for many years secretary of the Smithsonian Institution, and President of the National Academy of Sciences in Washington. He lived in Washington during the later years of his life, and died there in 1878.

In 1838, a German named Steinheil discovered that the earth itself would carry back the electric current to its starting-place, and that it is only necessary to bury the wires in the earth, or "ground" them, in order to complete the circuit. Many discoveries and improvements have been made since then by Stearns, Edison, and others, and it is now possible to send eight messages—four each way—over one telegraph wire at the same time. Many improvements have been made in the instruments also, and speed has been raised to almost lightning rapidity. All these improvements, however, are so technical that we have not space to consider them here, and must go on to think of the makers of the submarine telegraph.

Of all the men, and they were many, whose work made the submarine telegraph possible, the greatest was Sir William Thomson, whom we know better as Lord Kelvin. He was born in Belfast in 1824, the son of a professor of mathematics, and, when only eleven years of age, was received as a student at Glasgow University. He afterwards studied at Cambridge University and at Paris, and was a professor in Glasgow University before he was twenty-three. All his life he worked out problems of the most difficult character, as to the strength, action, and effects of electric currents under all sorts of conditions.

LORD KELVIN'S GREAT WORK FOR SUBMARINE AND WIRELESS TELEGRAPHY

To most people it would have seemed dry, unproductive work, but his splendid mind was able to apply to practical uses the discoveries resulting from his delicate experiments and profound calculations. One result was this, that we have those wonderful cables running under the sea to all parts of the world, as we read on page 2496. Bright and Field had the task of laying the cable, but it was the great brain of Kelvin which thought out the instruments which made it possible to record and read the messages. This is only a fragment of what Lord Kelvin did for telegraphy. Some of the most delicate and beautiful portions of his work are employed for the receiving and

recording of wireless messages. It will be sufficient, however, for us to remember that, as we grow older, we shall more and more trace the labors of Lord Kelvin, and understand the value of his work for the science of electricity in general, and of telegraphy in particular. Lord Kelvin died on December 17, 1907.

Many improvements have been made in the instruments used in ocean telegraphy, and one of the most important was made quite recently by an American army officer, George Owen Squier. By the old method, messages are recorded by a wavy line, which is difficult to read, and cannot be sent quickly. By using the Squier improvement messages can be recorded by a series of dots, and this enables many more messages to be sent within the same period of time.

So far we have considered only the telegraph, but to most of us the telephone is a still more wonderful and beautiful instrument. By its help we can talk to friends who are hundreds of miles away. We can take up the telephone receiver in San Francisco, and converse with some one in New York as clearly and easily as if they were in the next room.

The heliograph is a sort of natural telegraph. Messages are heliographed by the flashing of the sun's rays from a small mirror. The Morse alphabet is used, and the flashes are long and short to represent dashes and dots.

This photograph is by Messrs. Gale & Polden.

THE EXPERIMENTS THAT LED TO THE FIRST TELEPHONE

The principle of the telephone is explained on page 335 so that we need not touch upon it again. It is such a marvelous instrument that it seems extraordinary that the idea of it should have occurred to several minds.

But several men did think of it. They thought of it long ago, when, in 1667, Robert Hooke made sound travel, not by electricity, but along a stretched-out wire. They thought of it again when Wheatstone made the sound of a musical box travel along a deal rod from a cellar up into a hall where a large audience was listening. But in 1837, the year that the telegraph was patented in England and America, Dr. C. G. Page, an American, published an essay on the music produced by an electro-magnet at the instant when the circuit is closed. That was the beginning of the idea to make electricity carry the voice.

Six years passed, and then a clever man named Johann Philip Reis took up the theory, and, working steadily on until 1861, actually produced an electric telephone which carried music and vocal sounds, but not speech. The principle was much the same as that now employed, but he had not reached perfection.

The world waited until 1876; then a strange thing happened. Two men, both of whom had been working on the idea of a telephone, appeared at the Patent Office on the same day, and within a few hours of each other. One of them was Elisha Gray, the other Alexander Graham Bell.

TWO MEN WORKED TO INVENT THE TELEPHONE

Elisha Gray was an inventor who lived at Barnesville, Ohio, where he was born in 1835. He had already taken out a patent for a device for a telegraphic apparatus when on February 14, 1876, he filed a notice of his plans for a telephone instrument.

He lived until 1901 and made many inventions for the improvement of telegraph and telephone instruments. But he never worked out the ideas set out in the notice filed in 1876, for although he did not then know it, the telephone had already been invented.

Two hours before Gray's notice was filed, Alexander Graham Bell had appeared at the same office, and made an application for a patent for an actual working telephone, and with his application presented working plans from which his instrument could be made. The patent was granted and six months afterward he built the first real telephone line at his father's home at the city of Brantford in Canada.

It was a most extraordinary thing that these two men, unknown to each other, should be working at the same time on the same problem, and on the same day should appear at the Patent Office in Washington.

Alexander Graham Bell was born in Edinburgh, Scotland, in 1847. He commenced his education in Edinburgh, and afterwards went to the University of London, where his father was a lecturer. In 1870 he came out to Canada, where he lived for two years, and then removed to Boston, where he taught in the Boston University. Alexander Melville Bell, his father, had always been much interested in the hard lot of the deaf and dumb. He had worked out a method of teaching them to speak, and while he lived in Canada young Alexander Graham Bell devoted himself to teaching this method in an institution for the education of these sadly afflicted people. He has always kept his interest in the subject of the education of deaf people, and has used a large sum of money for this purpose.

After he went to Boston, he began to study sound waves, and to experiment with what he called a "harmonic telegraph." But all the while that he was at work on this instrument, he was haunted by the belief that an instrument could be made by means of which the sounds of the human voice could be carried over the wire. Telegraph messages were transmitted by sound. Why, he thought, could not the varying sounds of speech be transmitted in something the same way? Curiously enough he carried on most of his experiments at Salem, near Boston, where, about forty years before, Doctor Page had made the discovery that gave the first hint of the possibility of using electricity to convey the sounds of speech.

One day, while Alexander Bell was working at his telegraph instrument, something happened that caused a sound to travel from the transmitter to the receiver, at which he was listening. That was enough to convince him that he was right in his belief that he could invent an instrument through which the voice could be sent and received. Dropping forever his work on his "harmonic telegraph," he patiently set himself at the task of unraveling the mystery of the sound that he had heard. For months he could think of nothing else, and the result was the instrument which has almost revolutionized the business of the world.

He has made many other inventions, and one of these, the telephone probe, has proved to be of great service to mankind. This valuable instrument enables surgeons to find out where a bullet or fragment of metal has lodged in a man's body, without putting him to the added pain of probing the wound, and has been the means of saving much pain, if not many lives.

THE MAN WHO MADE LONG DISTANCE TELEPHONING POSSIBLE

When the telephone was first put into use, no one dreamed that, within the lifetime of its first inventor, a man could speak across the continent from the Atlantic to the Pacific, or could speak in Washington and, by means of the telephone instrument and wireless system, be heard in Paris. That is a wonder at which we never cease to marvel. Perhaps if we realized the amount of deep learning, profound thought, and careful, patient work that have gone to bring this about, we would marvel still more. Men of many nations worked on problems which had to be solved, and many inventions were made, before the great result could be achieved.

As telephone instruments were made more perfect, it was found that they could be used to speak over much greater distances than had at first been thought possible. Still, when the wires were carried beyond a certain point, the sound became very indistinct.

After all the mechanical difficulties had been overcome, it was found that a scientific problem which no one had solved stood in the way of using the telephone over long distances. For a little while this prevented any progress being made. Before long, however, the obstacle was overcome by Professor Pupin of Columbia University, who solved the problem and invented a device to overcome the obstacle which it set up.

The honor due for this advance belongs partly to America and partly to little Serbia, for although Michael Idvorsky Pupin was born in Hungary in 1858, his parents belonged to the Serbian nation. He first went to school in his native town, but while he was still very young he was sent to a better school at Prague in Bohemia. At the age of six-

teen he moved to the United States and nine years afterwards he graduated from Columbia University. Later on he studied at Cambridge University in England and at the University of Berlin. When he finished his studies abroad he came back to America, and has since been engaged in teaching science at Columbia University, in deep study of electricity and in writing.

GUGLIELMO MARCONI, THE GREAT INVENTOR OF WIRELESS TELEGRAPHY

In another place in the book, we have read of the discovery of the Hertz or electric waves; now we come to the story of Guglielmo Marconi, the man who learned how to use these waves to send messages round the earth in a moment of time.

Guglielmo Marconi, an Italian whose mother was an Irish woman, was born in Bologna in the year 1874. From childhood he was intensely interested in electricity, and made it his chief subject of study at Bologna University. When he first read of the Hertzian waves, he saw in a flash that they could be used to send messages without the aid of wires. He was astonished that no one had yet discovered how this could be done, and before long he began to make experiments in the garden of his home, with the aid of poles and of simple instruments that he made himself. Very soon, to his unbounded delight, he was able to send messages across the garden. Then he went to the country to experiment over longer distances, and when he succeeded in sending messages a distance of two miles, he offered his discovery to the Italian government. The government did not accept his offer, so Marconi wrote to Sir William Preece, the chief of the British Postal Telegraph Service, who invited him to London. He accepted the invitation, and you can judge of Sir William's astonishment when a slim youth of twenty was announced in his office as the scientist Marconi with whom he had been in correspondence.

In England, Marconi went on with his experiments with great success. The English government took the matter up and his instruments were installed on a lightship stationed on the Goodwin Sands. A wireless service was established between England and France. Some of the large liners were equipped with Marconi's instruments, a station was built at Poldhu in Cornwall, and messages flew to and fro between the land and outgoing and incoming ships.

THE SECRET OF MARCONI'S KITE-FLYING

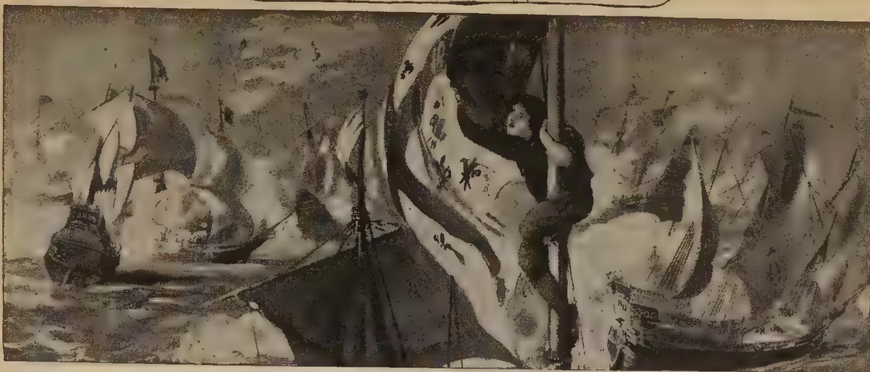
Then Marconi went to Newfoundland to fly kites. Now we have all tried to fly kites, and perhaps you will say, what a funny thing to do! But Marconi's kite-flying was done with a purpose. He wanted to prove that messages could be sent across the Atlantic, and he did it. He fastened a receiving instrument to a huge kite. To fly his kite, he used wire, fastened securely and attached to an instrument which had a telephone receiver, and by this means he was able, on the cliffs of Newfoundland, to catch a message sent to him from Poldhu. That was at the end of 1901, and since then so many wonders have been worked by the wireless telegraph that we have almost ceased to marvel.

In 1915 wireless messages were sent from the eastern to the western coast of this continent and to Hawaii. In 1916 they were sent from Arlington to Japan, and between Mexico and Germany, and, greatest wonder of all, the sound of the human voice has been carried from Arlington to Hawaii, and from Arlington to Paris, without the aid of wires.

Many men have helped in the development of the wireless telegraph. Sir Oliver Lodge, Sir William Preece, Lee de Forest, R. A. Fessenden, Valdemar Poulsen, Michael Idvorsky Pupin, Ferdinand Braun and Max Wien are only a few of the men who have done great work in this field. But to Marconi alone belongs the honor of seeing the one way in which messages could be sent without the use of wires. All the others have followed in the pathway that he showed.

Like Alexander Bell, he has lived to see the greatness of his work appreciated by the world. Many honors have been given to him, but probably nothing has ever brought him greater triumph than he felt when he heard the first faint signal caught and recorded by his first little instrument, and knew that he, a boy of nineteen, had mastered one of the greatest powers of nature. He has had much happiness in his life, but nothing can have given him purer joy than the knowledge that his discovery has been the means of saving thousands of human lives.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4549.



THE BRAVE APPRENTICE

CONTINUED FROM 4357

THAT some of the greatest men have risen from the humblest circumstances is true in almost every walk of life, and certainly the Navy is no exception. Somewhere about the year 1680, a small boy sat working upon a tailor's bench at Bonchurch, in the Isle of Wight. His master being out of the way for the time, the boy had dropped his needle and was gazing out to sea, wishing he was anywhere but in that shop. He was a pauper orphan, and had been apprenticed by the parish authorities to a tailor.

As he was dreamily gazing out to sea, a squadron of British warships came into sight round a bend of the coast, and, without a moment's hesitation, the boy threw down his work, and, running out of the shop, rushed to the beach, where he jumped into a boat, and rowed as hard as he could to the admiral's ship.

The conditions of life on the warships were then very hard indeed, and recruits were wanted badly, for men were not anxious to join the Navy; so when the little lad offered his services they were readily accepted.

It was not long before he saw active service, for on the very next morning the British ships fell in with a French squadron, and fighting began at once. The boy did his duty well, running hither and thither, as he was bidden, and taking a keen interest in the exciting events around him. At last, when the fighting had been going on for some time, and there seemed no sign of a definite result, the boy asked a sailor: "How shall we know when the enemy has given in to us?"

"Oh," replied the man, pointing to the flag flying at the masthead of the French admiral's ship, "as soon as that flag is hauled down the enemy will have given in, and victory will be ours."

"Is that all?" said the boy, and hurried away.

In those days vessels did not fight as they do now, with miles of sea between them, and sometimes out of sight of one another. They ran up side by side, and the crew of each tried to board the other. The tailor's boy sprang upon the deck of the French admiral's ship, which was alongside his own, and, unnoticed in the excitement, nimbly climbed up a rope-ladder, and eagerly seized the French admiral's flag. Then, wrapping it round his body, he descended with it to the deck, still unperceived by either the French or the English sailors.

No one had seen his daring action, but presently the English sailors noticed that the French flag was gone, and, supposing that the enemy had given in, they rushed upon the deck of the French ship with such impetuosity that the enemy was filled

with consternation and dismay. The French gunners fled from their guns, and within a moment or two the ship was actually in the possession of the English. Just as victory was assured, the apprentice sprang forward, and showed the captured flag to his comrades, who received it with the greatest astonishment.

The news soon spread, and the boy was led with his prize into the presence of the admiral, who praised his bravery and enterprize, and promoted him to the rank of midshipman on the spot. That a lad who could do such an action as this should rise to distinction in the Navy is not surprising. The young midshipman was promoted again and again, until he reached almost the highest rank in the British Navy, and became known in history as Admiral Hopson.

THE WOMAN WHO CLOTHED THE POOR

IT is not only great and heroic acts, which appeal to the imagination, that can be described as golden deeds. Many a quiet deed of kindness or a work of mercy done away from the public gaze, and with no thought of praise or reward, has had far-reaching effects for good, and encouraged others to emulate the worthy example set them.

A striking example of this is the case of Dorcas, or Tabitha, the Christian disciple of the early Church, whose death in the midst of works of charity and helpfulness caused great distress among the poor widows of the town of Joppa, on the coast of Palestine.

We do not know when Dorcas first became a convert to Christianity, but she soon learned the true spirit of the Master, as her kindly thought for the poor proves. She is described to us by St. Luke as "full of good works and alms-deeds which she did," so that not only had she physical beauty, as the meaning of her name suggests, but she was beautiful in character and in soul.

Then, as now, the poor women of cities and towns found it difficult to obtain proper clothing for themselves and their children, and it was in order to meet this need that Dorcas gave of her time and means.

She did not simply distribute so much money, and think that thereby her duty to the poor was fulfilled, but she worked with her own hands and made garments of various kinds—coats and cloaks—which she distributed freely among the poor and needy women and children of her town. The gratitude which the people felt for her on account of her loving service is shown by the fact that at her death they all came together to mourn her loss, and to pay the last tribute to her memory. Had there been no other result from her life and loving work than the good that came to the poor of Joppa, the name of Tabitha, or Dorcas, would have deserved to live and be handed down, as it has been. But the result was far more lasting, and is seen right down the ages since those times of the early Church to the present day, and never did the bright example of Dorcas give greater inspiration than it is giving to-day to thousands of willing helpers who are trying to bring cheer to the poor.

DORCAS GIVING GARMENTS TO THE POOR

There are few Christian churches to be found in this country, at any rate, without their Dorcas society, the aim and object of which is to do the very same work as Tabitha did nearly nineteen centuries ago.

It would be impossible to say how many of the naked have been clothed in all the ages, and how much joy and happiness have been brought to the poor, solely as a result of the example first set by Dorcas in the town of Joppa. Such acts as she performed are, we must all agree, golden deeds in the very highest and truest sense of the term.

THE VENERABLE BEDE TRANSLATING THE GOSPEL INTO ENGLISH IN THE LAST HOURS OF HIS LIFE

This picture, by J. Doyle Penrose, shows us the Anglo-Saxon teacher Bede dictating the Gospel of St. John to a boy, as told on page 4452. By permission of the Autotype Co.

THE WONDERFUL STORY OF THE VENERABLE BEDE

THE life of Bede was a beautiful one, spent far from the din of the battlefield, the bargaining of the market, and the pleasures of the court.

All his days were passed, though he was the greatest scholar and teacher of Anglo-Saxon times, in the peaceful monasteries at Wearmouth and at Jarrow. There he studied, wrote, and taught the six hundred youths who gathered round him. For them he wrote textbooks covering the then known field of knowledge; for them, and for the people, he wrote a history of the English Church, telling how Christianity was brought into the country.

So earnest and noble-minded a scholar could not bear to think that the greatest book ever written should remain a sealed book to every person unable to read Latin; and he was determined, if God gave him strength to do it, to translate at least the Gospel of St. John into Anglo-Saxon, that all might hear and understand it in their own tongue. Forty-four works, mostly in Latin, he had written during his busy life of teaching; one more—the Gospel of Love—he would leave behind him. He was getting ill and feeble, but he would not leave even to the ablest pupil a work so important as the translation of the Gospel. "I will not have my boys read a lie," he declared, "nor labor fruitlessly after my death."

Day by day Bede grew weaker; but, refusing to rest, he continued cheerfully dictating to his scribe. One of his scholars, Cuthbert, wrote a description of the last hours of his revered master, and an artist has painted a beautiful picture, given on page 4451, of the old man on his couch in his little cell, with a youth before him eagerly taking down his words.

In his History of the English People, the historian Green thus describes the scene:

> The dawn broke on another sleepless night, and again the old man called his scholars round him and bade them write.
>
> "There is still a chapter wanting," said the scribe as the morning drew on, "and it is hard for thee to question thyself any longer."
>
> "It is easily done," said Bede. "Take thy pen, and write quickly."
>
> Amid tears and farewells the day wore on to eventide.
>
> "There is yet one sentence unwritten, dear master," said the boy.
>
> "Write it quickly," said the dying man.
>
> "It's finished now," said the little scribe at last.
>
> "You speak truth," said the master. "All is finished now."

Placed upon the pavement, his head supported in his scholar's arms, his face turned to the spot where he was wont to pray, Bede chanted the solemn "Glory to God." As his voice reached the close he passed quietly away.

THE LITTLE GIRL TRUSTED WITH STATE SECRETS

WE look on Oliver Cromwell as a stern character, harsh to his opponents, and forbidding in his ways. Yet he could be very gentle to a little child; and for his little granddaughter he kept a warm place in his heart. He liked to have the little girl often before him; and when she was only six years old would keep her by his knee as he sat at a Cabinet Council discussing affairs of State. Some of his Ministers thought it unsafe to have even such a little girl listening while they talked about important matters concerning the country, and they let Cromwell know their fears.

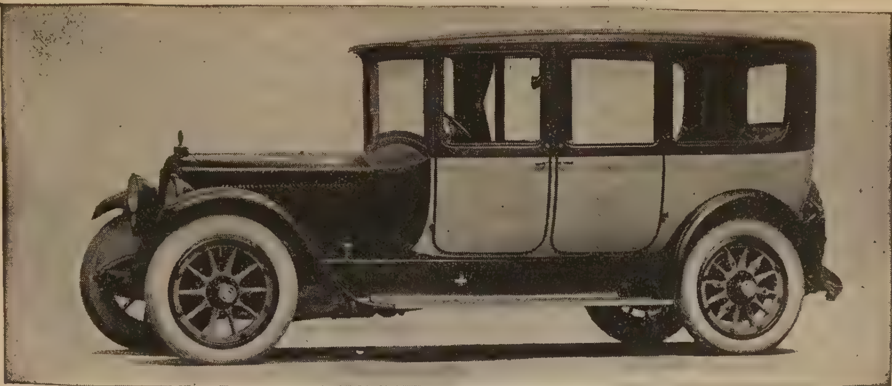
"Why, there is no secret I would trust with any of you that I could not trust with that infant," was the reply.

Determining to prove to his Ministers that his trust in his little granddaughter was well merited, Cromwell one day whispered to her something in confidence, saying it was a secret, and she must not tell it. He then set her grandmother and mother to try to get the secret from her.

But no threats or bribes, nor even whipping, could make the little girl disloyal to the trust the grandfather put in his Puritan grandchild. At last they gave up the attempt to get the secret from her, unable to resist longer the plea that her grandfather had trusted her with a secret and she must keep it, though she did not wish to disobey her mother.

And so Cromwell's Ministers had no more fear that State secrets would be told when the loyal little girl knew them.

THE NEXT GOLDEN DEEDS BEGIN ON PAGE 4577.



A Modern Closed Car, called an Imperial Limousine.

HOW MOTOR CARS ARE MADE

CONTINUED FROM 4269

THE title of this story is really too large, for we can not tell you how motor cars are made in one story, or in a dozen, for that matter. The motor car as we see it in the streets is made up of thousands of parts, made from many different materials. It is manufactured in great shops with the aid of much complicated machinery. We shall try, however, to give you an idea of the way a car is put together.

A motor car is simply a car that moves of itself. A locomotive is a motor car, and so is a steam roller. We now mean by the words, however, a car that travels on an ordinary road, and carries passengers, or freight. In fact we usually mean a passenger car, and call the freight car a motor truck. Most of them are run by gasoline engines, though there are many electric cars, and a few steam cars.

MOTOR CARS NEEDED THE PROPER ENGINE

The idea is not new. Over two hundred years ago, Sir Isaac Newton thought of the idea, and in 1770 a Frenchman built two steam cars which ran. Other men built cars in England, and we show you a picture of one of them on page 6050. All of them were very heavy and very clumsy, and soon went out of use. For a long time men had to depend upon the horse to carry them about.

Not until the internal-combustion engine was invented did men again try to make a motor car. You know the difference between an engine of this kind and a steam engine. In the second, heat is applied on the outside of the boiler to make steam, which pushes out the pistons of the engine. In the other, gas is admitted to the cylinders and set on fire. The explosion drives out the pistons. On pages 1788 and 1789 you will find a splendid diagram which shows you how an engine of this kind works.

This engine was not perfect at first. It had only one cylinder, and often got out of order, but men worked on it for years, and many improvements were made. When this engine began to work well, the motor car as we know it became possible. No one man can be given the credit for the engine. It is not even certain who first thought of the idea, but our motor cars, motor boats and aeroplanes all depend upon it. Really reliable cars were not made until after 1900.

In making the first motor cars men tried to make them as much like vehicles drawn by horses as possible. On another page we show you a picture of a car made in 1899. Later, when better roads were made, so that the body could hang lower, the wheels were made smaller, and they were

Copyright, 1918, by M. Perry Mills.

fitted with pneumatic tires which made riding much easier. Many inventions have gone into the car until now it seems as if there is little more to be done.

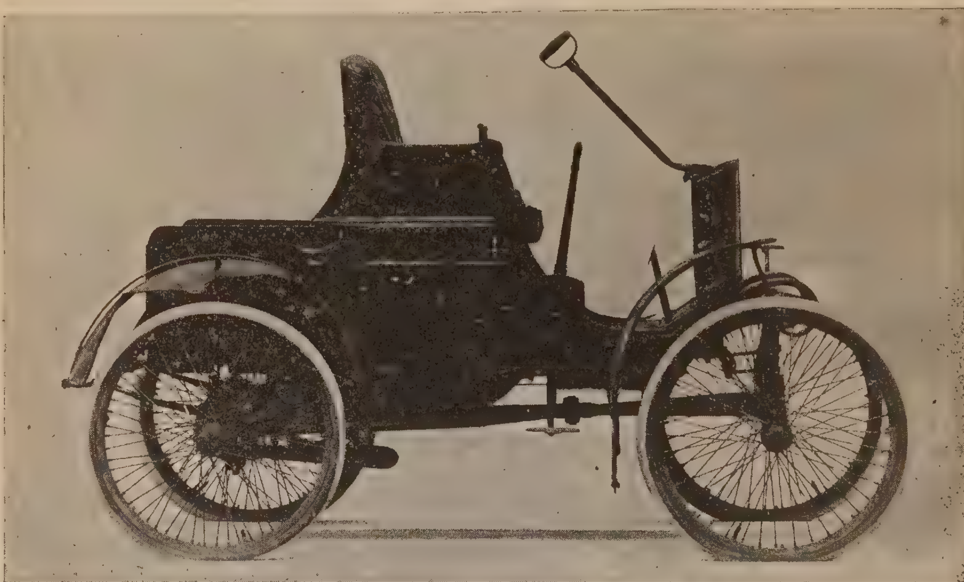
INSIDE A GREAT FACTORY WHICH MAKES CARS

In a great factory there will be several departments. Some manufacturers buy their metal parts already cast, but others melt their own iron, steel and brass, and cast the parts they need. This operation is very interesting and is about the same, no matter what the metal. Boxes without top or bottom are prepared. One is filled nearly full of a particular kind of sand which is kept just a little moist. Then a pattern, generally made of wood, though sometimes of metal, is laid on it. Another box is placed above the other and sand is filled in around the pattern and packed closely. Then the upper box with its sand may be lifted off, even though it has no bottom. The pattern is then taken out of the lower box. The upper box is then replaced above the other. The sand holds its shape, and inside the boxes is a hollow the exact size and shape of the pattern. The molten metal is then poured through a hole left for the purpose and fills up the mold. When the metal has cooled, the sand is taken away, and the part is taken out.

Some of the castings go to great ovens where they bake for hours. This makes them stronger or tougher. Some go to machines which pound them, and shape them; some go to be polished or to be joined to still other parts. There are thousands of separate parts in a motor car and one cannot keep up with them all.

More motor cars are manufactured in the United States than anywhere else, and the largest single factories are here. They make cars of different prices, from a few hundred to as many thousand dollars. All, whether they make cheap or expensive cars, use much machinery. In the shops there are machines larger than an ordinary room. Some stamp out great pieces of metal as if they were so much cheese. Lathes cut off shavings of steel as if they were soft wood. Some machines grind pieces that were purposely made a little too large until they are the proper size. Some of these parts must be accurate to a thousandth of an inch. Some machines drill holes into steel, a dozen, or twenty at a time, all exactly the right distance apart. It would be almost if not quite impossible to drill them so accurately by hand. Others cut cogs into wheels so that they fit exactly. There are thousands of machines in the different rooms, and they work with wonderful precision.

In the woodworking rooms, saws, planers and shapers are buzzing. Spokes and rims for wheels are being made. Holes are being bored or cut, and one part fits



The first Packard car was made in 1899. Notice how clumsy it seems to us now, and how uncomfortable it must have been. Compare it with the picture on the preceding page, which represents a recent model.

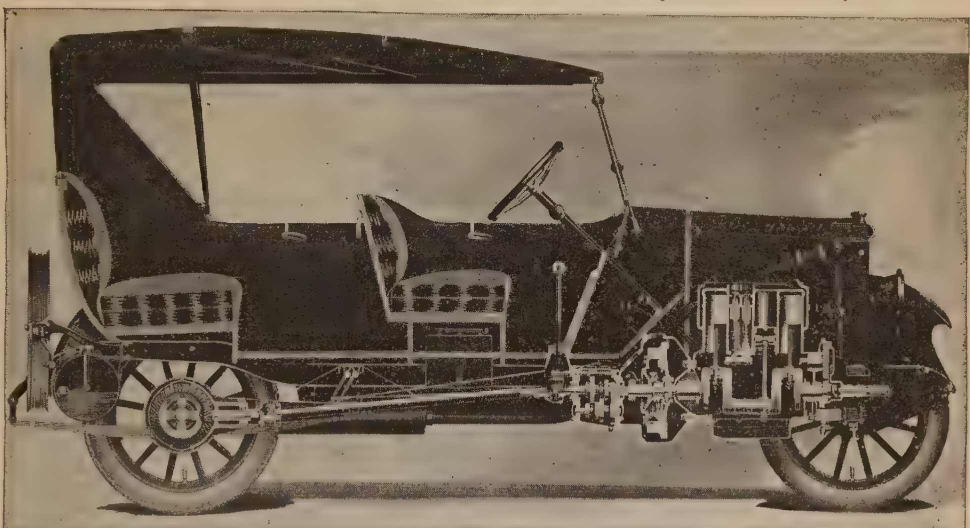
into another without a hitch. The wooden parts of the body are being put together before your eyes. There are great paint rooms where wood and steel are being covered. Much of the painting is done by a spray, but for some parts work with a brush is necessary. There are upholstering rooms where the cushions for the seats and backs are being fastened on.

So far you have not seen anything which looks much like a motor car. You have seen thousands of pieces of iron, steel, brass, bronze, nickel, wood, rubber and leather, some large, some small, which you are told are required to make a car, but that is all. How they can ever be put together you cannot understand. Let us go to one of the assembling rooms and see what we can see there. This is a a room where parts are assembled or put together. We wander into the room where engines are being assembled. We find here something like an engine on a moving truck raised conveniently above the floor. Part after part is added until the complicated machine, built as delicately as a watch, is completed. We are told that each is taken to another room, tested in every possible way, and then made to run for hours.

Let us now go to another room, and see how the car itself comes together. Men take the two long side bars, and quickly fasten the cross pieces which hold them together. The bare frame is placed in a truck which is drawn slowly and steadily along by a chain or belt. As it passes gangs of men attach the metal parts—springs, brackets to support the running boards, a muffler, the axles, and dozens of other things. A spray of naphtha cleans off all oil or dirt, and paint is sprayed on. The frame disappears into a drying room. When it appears on the other side, it gets a coat of varnish, goes through another hot room, and is then left to cool.

It resumes its journey. The engine is swung down from a loft, up from below, or comes along another track, and is fastened firmly to the frame, which we now call a chassis. The truck continues to move. To one side is a large stock room where thousands of parts are piled up in convenient reach. Each man or set of men attaches something as the car moves along. The body swings down from above. The wheels, tires, lamps, the clock suddenly appear. Perhaps a man rides on the car, working all the time until his job is done. Then he drops off and goes back to the place where he started, to begin again.

The car has finally traveled a long distance, perhaps a mile or even more. Every few yards an inspector has tested some part. It now comes to the end and is rolled off on the floor. Fill the tank with gasoline, and it is ready for the road.

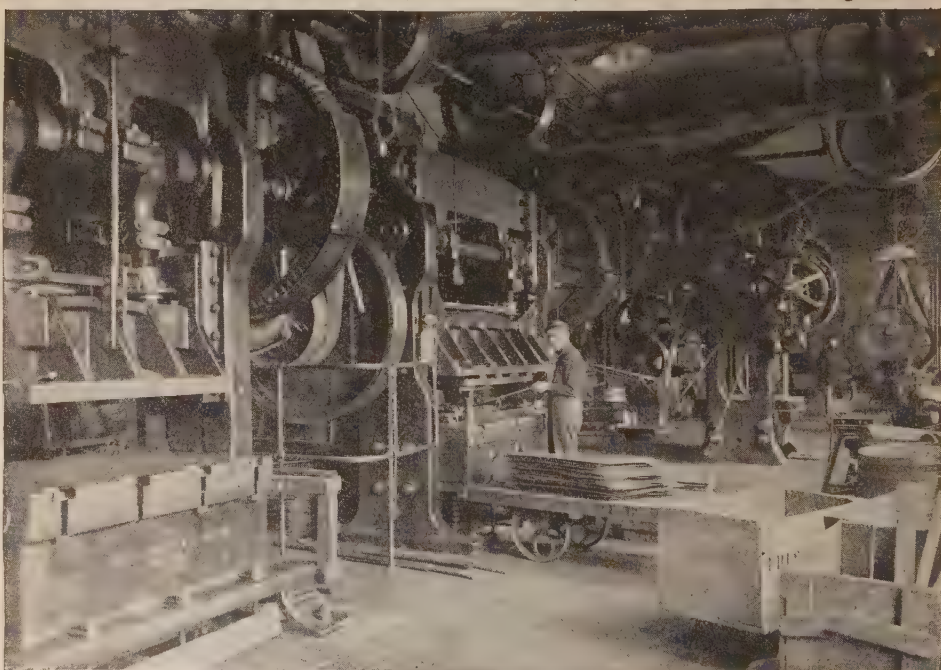


This is an interesting picture-diagram of an Allen car cut through the middle. If you will turn to page 1788, where a diagram of an engine is shown, you will understand how it works. The gear box is shown cut open, and you will also be able to puzzle out how the car can go at such different speeds.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4539.

MOLDING AND STAMPING PARTS FOR CARS

The process of molding is always interesting even if it is difficult to show in pictures. Here you see the men about to tap the cupola to let the melted iron run out into the large iron vessel. The iron will be poured into these boxes of sand you see here. As explained in the text, each contains an open space the exact size and shape of some part of a car, which is filled by the molten metal from the great ladle.



These enormous machines shape pieces of sheet metal for bodies as if they were paper. When the enormous jaws above come down they can bite the sheets of metal in two, or bend them to any shape desired. They exert so much force that they would flatten your watch or your ring as thin as a piece of paper.

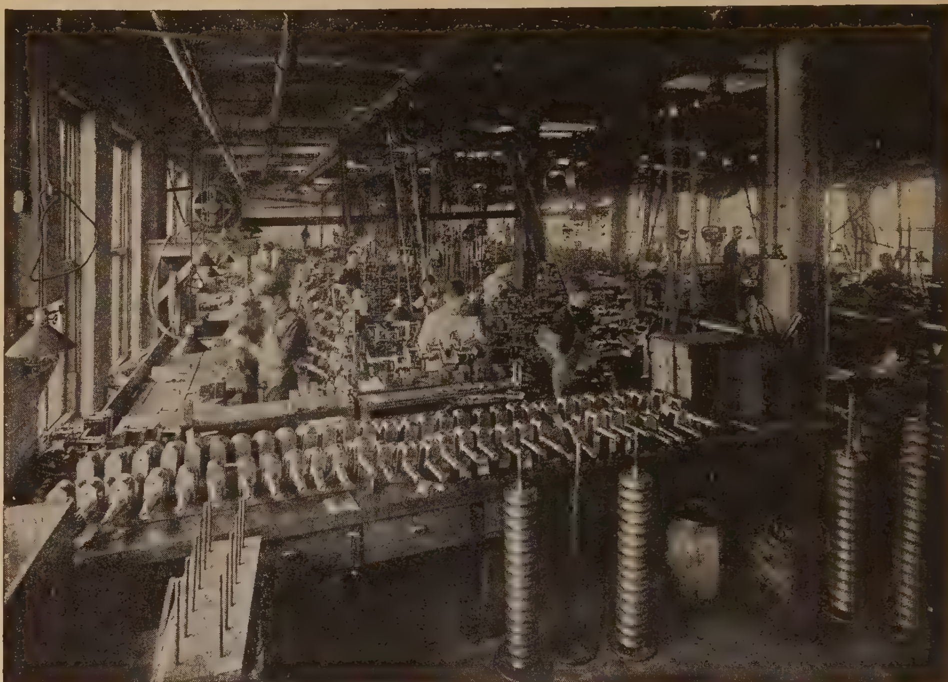
Pictures on pages 4456, 4458, and the lower half of 4459 by courtesy of the Cadillac Motor Car Company.

THE WORK OF THE MULTIPLE DRILL

This drill can be set to bore any number of holes in a piece of iron or steel. The part of the car in which the holes are to be made is placed on the traveling carriage and at the pleasure of the operator the drills descend and bore the holes in an instant. Drilling the holes by hand would take a long time and they would not be so accurately spaced.

Here you see a section of a workshop engaged in producing rear axles. On the left bolts are being placed in holes which have been drilled by the machines above, and on the right men are at work on the same part. The pictures on pages 4453, 4454, 4457, 4460, 4461 and at the top of 4459 by courtesy of the Packard Motor Car Company.

OTHER VIEWS IN THE MACHINE SHOPS

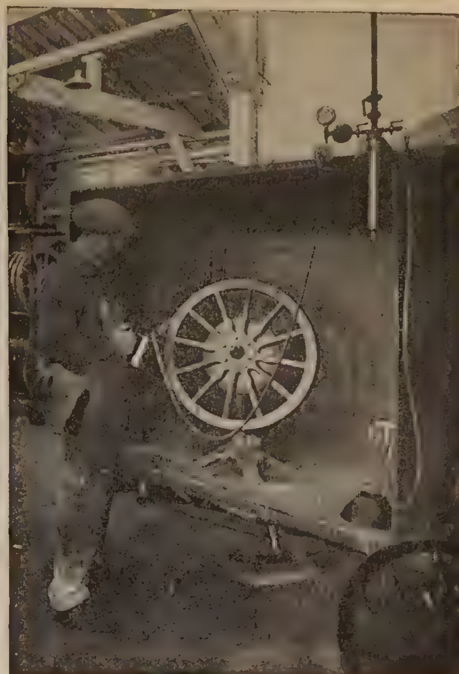


The crankshaft which is connected with the pistons of the engine bears enormous strains, and must be perfect. Here you see on the left shafts receiving the final polish and in the center the inspector is measuring them to see whether they are the proper size. He must take about twenty-five measurements, and at some places the shaft must be accurate to the thousandth of an inch. This paper is three times that.

Much of the body of the car is made of thin sheets of metal which have been stamped to the proper size and shape by the great machines shown on another page. Here you see the workmen putting the final touches on many different parts. Perhaps you can recognize where some of them belong in a completed car. Some are brass, some steel, and some, perhaps, are aluminum. Some of the parts are nickel-plated.

MAKING BODIES FOR THE CARS

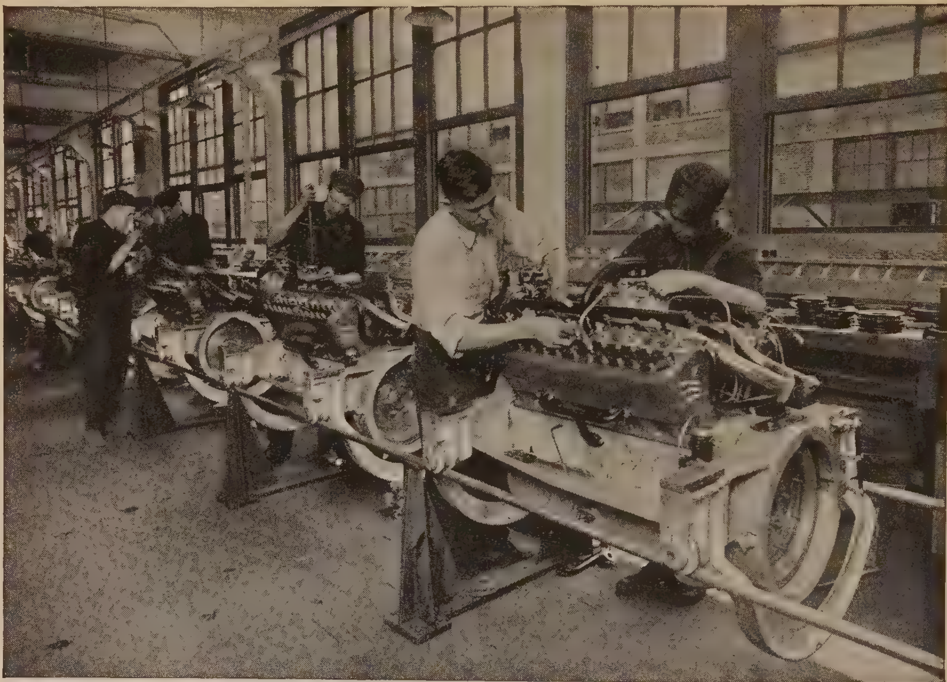
This automatic hammer is shaping a sheet of metal into a sweeping curve for the body of a car. The stamping machines cannot do quite this much, but the hammer does it rapidly, as it rises and falls.



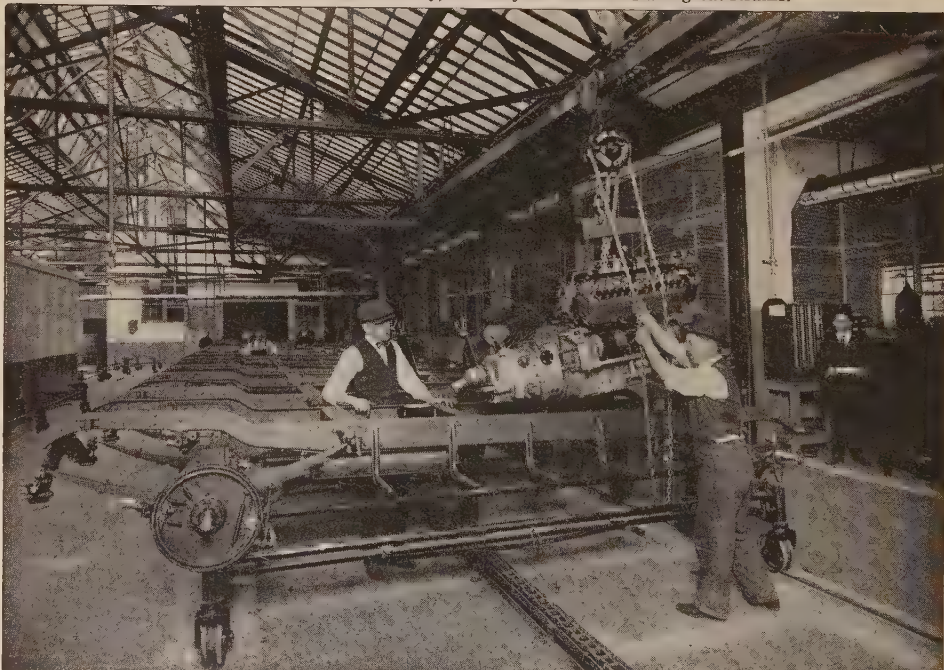
A tube through which compressed air passes is attached to the can of paint the workman holds. The paint is sprayed over the wheel more evenly and more quickly than it could be done by a brush.

Many closed cars or limousines, as they are called, have a wooden framework, covered with thin metal. Here are many bodies covered with aluminum. This, as you know, is the lightest metal in common use, but is very strong. These bodies will receive several coats of paint and varnish before they are completed. The touring car has a top of leather or fabric, which can be folded together, or else removed altogether.

THE ENGINE IS ALMOST READY TO RUN

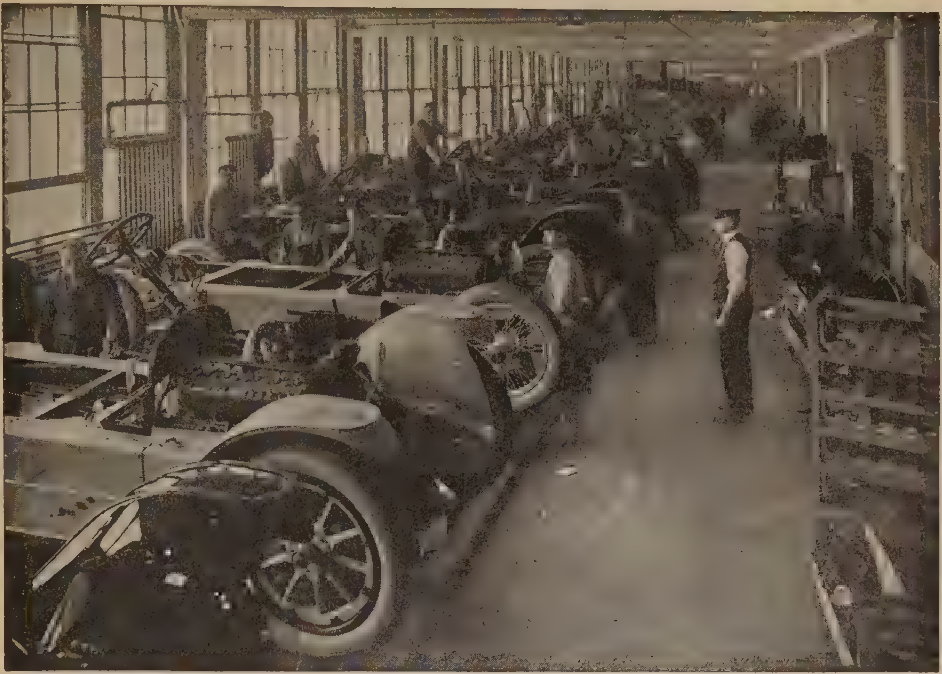


The crank case was placed on this moving truck some time ago, and as it went on, different men added the many different parts of the engine. It is now almost ready to be sent to the testing room. A high-grade motor engine has many parts, but is built with as much care as a watch, and runs quite as smoothly. All the parts must fit exactly if it is to be satisfactory, and they are made to stand great strains.



The engine is completed and is here being swung down upon the frame, which has been picking up parts as it, too, moved along on the truck. The engine will be fastened securely and then the frame will go on to have other parts attached. The frame may soon be called a chassis, which is French, meaning foundation. It means the whole of the running parts taken together, while the remainder is called the body.

THE CAR IS ALMOST READY FOR USE



The chassis continues to move on. On the right is the stockroom, where thousands of parts are stored in order. As the truck arrives, each man adds something to the car before him, sometimes riding on the truck or the car itself for some distance until he has finished his work. Then he returns to the starting point. It is marvelous to see how quickly the parts can be attached. Later the body is swung down.

What was a bare frame when we entered the assembly rooms, a mile or two back, has become a real motor car, completely equipped and ready to run out under its own power, and start on a journey across the continent. The many tags attached to the cars on the left show that they have been inspected by several different men in their progress. The responsibility for the work is easily fixed by this method.

ARBOR AND THANKSGIVING DAYS

This picture made from an old print, shows the artist's idea of the celebration of the first day of Thanksgiving at Plymouth, Massachusetts, about which the old records of the Pilgrim Fathers tell us. Its quaintness makes it attractive, even if it is not entirely accurate. In the early times of which it tells us, the day was kept as a solemn festival. Every one went to church and special sermons were preached.

The celebration of Arbor Day originated in the western prairie states, where there are very few trees, and a day was set aside for the planting of trees and vines and shrubs. In other states the rapid destruction of the forests has led the teachers to use the occasion to tell children of the importance of trees and to teach them to recognize the different kinds and their importance to the well-being of the nation.

WHAT THIS STORY TELLS US

EVERY nation has in the pages of its history some heroes, some great deeds or some incident in the national life which it desires to hold in remembrance, or some object to which it attaches some special significance. The United States is not behind in this. There are a number of the days on the calendar which are specially set apart as holidays, and this story tells us the special reason why this has been done. Most of these days are kept in remembrance of the past, one of them is kept so that the children of the present may be able to prepare a blessing for the children of the future.

THE DAYS WE CELEBRATE

CONTINUED FROM 4170

WHAT is a legal holiday? Almost every boy and girl will answer, "It is a day when all the schools and shops are closed and we don't have to work, and can have a good time." Yes, assuredly, a holiday is a day for having a "good time." But how many of you who hail Washington's Birthday and the Fourth of July and Thanksgiving Day so joyously ever stop to think of the real significance of the events which these holidays commemorate?

Such holidays are the memorial stones raised along the path by which a nation rose to greatness. Every country has its special days set apart from the routine work of the year in memory of some great man or great event in the nation's history or for the performance of some public duty to the State. Canada has Empire Day, Dominion Day, Victoria Day, the King's Birthday, Labor Day, and Thanksgiving Day. The United States celebrates the Discovery of America, the Landing of the Pilgrims, Thanksgiving Day, Washington's Birthday, Flag Raising Day, Independence Day, Lincoln's Birthday and (in the South) Jefferson Davis' and Lee's birthdays; Election Day, Arbor Day, Labor Day and several others in different states.

CHRISTOPHER COLUMBUS, DISCOVERY DAY, OCTOBER 12, 1492.

It was the unswerving determination and courage of one man—Christopher Columbus, an Italian by birth—that first brought the great continent, on which our nation was to rise, to the attention of Christian Europe.

Columbus believed that the world was round and that by sailing due west, he would at last come to the northern part of Japan (the East Indies) and thus open a new route to the East Indies, the land of pearls and silks and spices.

Many thought that Columbus was mad, and everywhere men were too busy to listen to the plans of the "visionary dreamer," as they called him. So poor Columbus wandered from court to court of Europe, trying in vain to procure financial backing for his scheme, until he came to Spain. Here Queen Isabella became interested in his plan and, as we read in the story of the queen on page 2445, she gave Columbus ships for his voyage of exploration.

The difficulties that Columbus faced on that first voyage can never be truly known. In a strange sea, with rough weather and a mutinous, terror-struck crew, it was only the indomitable purpose of the man that kept them on their westward course. Daily the sailors implored him to turn his ships toward home. They swore that they were in a haunted sea and a thousand unknown terrors dogged their footsteps.

"I will not turn back till, with the help of God, I find that land," Columbus said. In his poem, "Columbus," Joaquin Miller has given us a wonderful picture of the calm courage and dogged persistency of the great dis-

Copyright, 1913, 1918, by M. Perry Mills.

coverer. Every child should learn this poem, which you will find on another page of the book.

At last one morning a cry went up from the ships. Land was in sight! It was the island of San Salvador in the broad Atlantic. Thinking that he was near India, Columbus called the islands the West Indies.

Columbus made four voyages to the West and attempted to found Spanish colonies, but with little success. Courageous as his spirit was, he was ill from exposure in a foreign climate and he could not control the rough adventurers who came out to settle the colonies. Malcontents were continually returning to Spain to make trouble for him at court. They reported that he was mismanaging the colonies, treating the Indians badly, and taking the riches of the new land for his own use.

Much worried by these stories, Queen Isabella sent out a governor to inquire into matters. The new governor was jealous of Columbus and, landing with the authority of the Spanish sovereigns, he promptly threw him into prison and presently sent him home *in chains*. The proud heart of Columbus was almost broken. He went before King Ferdinand and Queen Isabella a gray, bent old man, the story of his misfortunes written on his face.

The king and queen were indignant at the treatment their faithful servant had received, and promised him four more ships for another voyage of exploration. On this last voyage Columbus sailed as far as the Isthmus of Darien, but his ships rapidly became so unseaworthy that he hastily turned them toward Hayti. They were unable to go further than Jamaica, where they remained stranded, and Columbus had to wait there for help which the governor refused to send for nearly a year.

Soon after Columbus returned to Spain, his good friend, Queen Isabella, died. King Ferdinand, absorbed in affairs of state, made no attempt to reward the old man for his years of faithful service to the Crown, and in May, 1506, he died in poverty, neglected by the country he had tried so faithfully to serve.

Four hundred years later the President of the great nation which had risen on the land discovered by Christopher Columbus made the following recommendation to the people of the United States:

"Now, therefore, I, Benjamin Harrison, President of the United States of America, in pursuance of the aforesaid anniversary of the discovery of America by Columbus, recommend the same as a general holiday for the people of the United States. On that day let the people, as far as possible, cease from toil and devote themselves to such exercises as may best express honor to the discoverer and their appreciation of the great achievements of the four completed centuries of American life."

This was the first celebration of Columbus Day. Now it is celebrated every year.

GEORGE WASHINGTON. PRESIDENT OF THE UNITED STATES. BORN FEBRUARY 22, 1732

It is interesting to know that the first public celebration of the birthday of General George Washington took place during his own lifetime. General Washington was one of the few great men who did not have to wait until after death for recognition of his greatness. Commander-in-chief of the American Army in the great struggle for independence and first President of the new nation, he was adored by his soldiers and revered by the people.

It was his friend, Count de Rochambeau, who, as a graceful acknowledgment of the good will between France and the new country, first celebrated the General's birthday. The French count had been in America barely six months and was stationed at Newport, Rhode Island, with his soldiers. His letter to General Washington, acquainting him with the holiday, is as follows:

"Yesterday (Sunday)," Count de Rochambeau wrote, "was the anniversary of your Excellency's birthday. We have put off celebrating that holiday till today, by reason of the Lord's Day, and we will celebrate it with the sole regret that your Excellency be not a witness of the effusion and gladness of our hearts."

Washington received this letter while in his winter quarters in New York State, where he was anxiously watching the movements of the British army.

"The flattering distinction paid to my birthday," he replied, "is an honor for which I dare not express my gratitude. I confide in your Excellency's sensibility

IN MEMORY OF WAR DAYS

This picture of Fort McHenry, near Baltimore, calls to mind the origin of our famous song, "The Star Spangled Banner." The author, Francis Scott Key, was confined on a British ship during the bombardment in September, 1814, and the flag mentioned in the poem was the one flying from the fort, which all the British power could not force the defenders to haul down.

The 30th of May is generally observed in the Northern states as "Memorial Day" and patriotic services are held and the graves of the soldiers who died during the Civil War are decorated. Flowers bloom earlier in the Southern states and therefore "Decoration Day," as the corresponding holiday is often called there, occurs as early as April, in some states, but usually early in May. There is no uniform date for the holiday in all the Southern states. Some states keep one day and some another.

to interpret my feelings for this and for the obliging manner in which you are pleased to announce it."

After the Revolution, the celebration of Washington's birthday very naturally took the place of the observance of the King's Birthday. Since then, Washington's birthday has been celebrated more or less generally throughout the United States, and to-day it is a public holiday in every state in the Union, and also in the District of Columbia, Porto Rico, Hawaii, and Alaska.

ABRAHAM LINCOLN. PRESIDENT OF THE UNITED STATES. BORN FEBRUARY 12, 1809

Abraham Lincoln was a child of the soil. Born in 1809, in Kentucky, in what was then almost a wilderness, he struggled upward with unswerving purpose against great odds. The contrast between the raw stripling of the western woods and the sad-eyed man at the helm of our nation through the storm of the Civil War is striking. When our country was divided against itself, the North against the South, brother's hand against brother, it was Abraham Lincoln who saved the Union.

"With malice toward none, with charity for all," with firmness in the right as God gave him to see the right, he steered the nation through the terrible time of its strife. "The strain of mind, the anguish of soul that he gave to his great task, who can measure?"

When President Lincoln died a martyr's death at the hands of a fanatic, his great mission had been fulfilled. The republic as a single, individual whole was "so firmly bedded in the hearts, the minds and the blood" of its citizens that the question of dissolution will never again enter their thoughts.

Look well at the face modeled by Borglum, of which you will see a picture on page 4664. Note the sane, sweet strength of the face, the firm, kind mouth, and the sad eyes and lined forehead that tell of great cares greatly borne. You will find the thrilling story of Abraham Lincoln in another place. He was one of the greatest men the world has yet seen, and his story should be graven on the heart of every American boy and girl, as a standard of high endeavor, and great thinking, without thought of self. Two of the greatest men in our history were born in February.

ROBERT E. LEE, BORN JANUARY 19, 1807: JEFFERSON DAVIS, BORN JUNE 3, 1808

The birthdays of the two great leaders of the Confederacy, General Robert E. Lee, and President Jefferson Davis, are set apart as holidays in many parts of the South. Jefferson Davis and Robert E. Lee, although they thought they owed a duty to their country, believed that they owed a higher duty to the states in which they were born, so when the Southern states seceded from the Union, these men followed their states.

Lee was earnestly opposed to disunion, but "If the Union is dissolved and the Government is disrupted," he said, "I shall return to my native state and share the miseries of my people, and, save in defence, will draw my sword against none."

Robert E. Lee, a distinguished engineer officer, had served in the Mexican War, and many thought him the ablest officer in the United States Army at this time. When the Civil War seemed about to come, President Lincoln sent Frank P. Blair to offer him the command of the Army of the United States. He was a graduate of West Point, and the offer of the command of the army in which he had spent his life was the greatest honor the President could offer him. But he did not hesitate an instant in taking the course that he believed to be right. "I am opposed to secession, but I will take no part in an invasion of the Southern states," he said, and resigned his commission.

A few days later he took command of the military forces of Virginia, then entered the Confederate service and finally became the General-in-chief of the Confederate army. General Lee's grasp of the situation in the South was masterly, and with the tremendous odds against him, he was able to win many victories, but finally surrendered with his army at Appomattox Court House.

General Robert E. Lee, was not only a great commander, but a great man. He had the gift that drew men's hearts to him, and his soldiers gladly followed him. When the Southern army was surrounded at Appomattox and General Lee, unwilling to lead his brave fellows to certain death, surrendered, the men could not understand what had come to them. They had been preparing for battle and they gathered around in their tattered uniforms to

listen to the announcement. General Lee had surrendered! It could not be possible! But it was, and the men who had followed him through battle, hardship and starvation, broke down and sobbed like children when they learned the truth.

General Lee bore defeat as greatly as he had borne his duties and loyally recommended the South to accept the result in good faith. He had gladly risked all his possessions in the desperate championship of the Southern cause, and at the close of the war he was offered the presidency of Washington College, at Lexington, Virginia, now Washington and Lee University. He held this position until his death, a little over five years after the close of the war.

Jefferson Davis, although perhaps not such a lovable man as General Lee, was a man of great ability and strength of character. He was popular throughout the South and at the beginning of the Civil War was elected President of the Confederacy.

The strain of the awful years of war and the hardships of his imprisonment in Fortress Monroe after the war, broke down his health, and when he emerged from prison he was an old man. The Southern people have never forgotten the hardships that this man bore for their sakes, and to-day his birthday, as well as that of General Robert E. Lee, is observed as a holiday in several of the Southern states.

THANKSGIVING DAY. THE LAST THURSDAY IN NOVEMBER

The Pilgrims had been in the New World for nearly a year. The springtime sowing had taken place and all the summer the fields had been watched with great anxiety, for all knew that their lives depended upon the coming harvest. The summer crops came to a richness of fruition beyond all expectation and late one day in the fall Governor Bradford sent four men into the forests to shoot wild birds. "We will hold a harvest feast of Thanksgiving," he said, and invited the Indians who had been friendly to the strangers to rejoice with the white men. The Indians came bearing gifts of venison, and the harvest feast lasted three days.

This was the first Thanksgiving Day celebrated in America and little by little as new colonies settled the land the custom of a yearly Thanksgiving spread throughout the country.

General Washington perfectly expressed the spirit of the day in his Thanksgiving Proclamation in 1789:

"Whereas it is the duty of all nations to acknowledge the providence of Almighty God, to obey his will, to be grateful for his benefits, and humbly to implore his protection, aid and favors . . Now, therefore, I do recommend and assign Thursday, the 26th day of November next, to be devoted by the people of these States to the service of that great and glorious Being, who is the Beneficent Author of all the good that was, that is, or that will be; that we may then all unite in rendering unto him our sincere and humble thanks for his kind care and protection of the people of this country, and for all the great and various favors which He has been pleased to confer upon us."

For a long time the celebration of Thanksgiving in the South was considered a relic of puritan bigotry, and it was not until 1857 that the day began to be observed there. Until the Civil War the celebration of the day was merely a state affair. During the Civil War it was suspended for a time, but in 1864 President Lincoln issued a proclamation appointing the fourth Thursday in November thereafter as a National Thanksgiving Day. When Lincoln was assassinated it almost caused this rule to pass out of existence, but the succeeding presidents took it up and since then Thanksgiving Day has been regularly observed throughout the United States. The proclamation by the president is sent to the governors of the different states, each of whom issues a corresponding proclamation for his own state.

PATRIOTIC DAYS. FLAG RAISING DAY. JUNE 14, 1777

Flag Raising Day was first recognized on June 14, 1894, when, at the request of "The Sons of the Revolution" and "The Colonial Dames of America," the Stars and Stripes were raised on all the public buildings, to commemorate the first use of the national flag.

The first American flag is said to have been made by Mrs. Betsy Ross, an upholsterer and seamstress who lived in Philadelphia. The story of why the stars and stripes were adopted is told in another place.

The thirteen white stars in the blue field in the upper left-hand corner of the new flag represented the thirteen colonies, as did also the thirteen alternating stripes of red and white. Later when Vermont and Kentucky entered the Union the number of stars and stripes was increased to fifteen, but still later Congress voted to return to the original thirteen stripes, adding a new star on the fourth of July following the admission of each new state.

Previous to the adoption of the national emblem each colony had its own flag. But when the new flag was approved by Congress, it was at once copied by patriots all over the country.

It was the sight of this glorious flag floating on Fort McHenry that inspired Francis Scott Key, who had been detained on one of the British ships, to write our national song "The Star Spangled Banner," which you will find in the Book of Poetry.

DANGEROUS FUN

INDEPENDENCE DAY. THE FOURTH OF JULY, 1776

Independence Day is a holiday that is observed in each and every state in the Union, and celebrates the adoption on July 4, 1776, of the Declaration of Independence, which declared our separation from Great Britain. It was Richard Lee who proposed to Congress "That these United colonies are and of right ought to be, free and independent states; that they are absolved from all allegiance to the British Crown; and that all political connection between them and the State of Great Britain is, and ought to be dissolved." John Adams seconded the motion, and Thomas Jefferson drew up the Declaration of Independence which has made him famous forever.

At the time of the adoption of the Declaration, John Adams wrote his wife a letter which reads like a prophecy: "I am apt to believe," he said, "that it (the day) will be celebrated by succeeding generations as the great anniversary festival. It ought to be solemnized with pomp and parade, with shows, games, sports, guns, balls, bonfires and illuminations from one end of this continent to another, from this time forward for evermore."

With true patriotic fervor Americans have thrown themselves into the celebration of this glorious event, and, whereever they may be, few of them forget to hold festival in honor of the birthday of the nation. There was a time, not very long ago, when children, and many grown up people too, thought the best

way to mark the day was to make as much noise as possible with firecrackers, or even firearms. But these days are past, and the day is spent in ways that are more worthy of the nation.

A DAY OF SORROW AND PRIDE. MEMORIAL DAY. MAY 30TH

From 1861 to 1865 our country was convulsed by a terrible Civil War. Brave men left their homes and their families by thousands to join the Army of the Blue or the Gray. Men burned with the zeal of patriotism, and whether they fought for the Union or for the South, they fought for the cause they thought was right. The women of the North and the South remained at home to sew and pray for the safety of their loved ones.

At last peace was established. The Union was saved, but at the cost of thousands of the lives of our country's bravest men. There was scarcely a village or a neighborhood in the North and none in the South that did not mourn its dead.

The women of the Confederacy began to go at various times in different places to strew flowers on the graves of their soldiers, and presently the beautiful custom spread to the North. General John A. Logan, commander-in-chief of the Grand Army of the Republic, set aside May 30th as Decoration Day for the graves of the Union soldiers who had died in the Civil War. Gradually the observance spread from state to state. The name was changed to Memorial Day, the better to voice the feelings of those who observed it. Each year the governor of each of the Northern and Western states proclaims the day as a legal holiday. As flowers appear earlier in the South the date of the observance is earlier there, in some states on April 26th, in others on May 10th.

ELECTION DAY. SET APART TO VOTE FOR OFFICEHOLDERS

We have been considering holidays which are memorial days, days set aside in memory of some great event or some great man. Now we come to those days which have been made holidays for the performance of some public duty.

Presidential Election Day comes once every four years and Congress has appointed the first Tuesday after the first Monday in November for this purpose, and almost all the states have chosen the same day for the election of their State officials.

No day brings greater responsibilities than Election Day. In most states every man or woman over twenty-one years of age, native-born or naturalized, may go to the polls to cast their votes for the men who are to govern them and make their laws. In olden days the government was in the hands of a powerful few and it is only within a few generations that the franchise has passed into the hands of the citizens.

Since the signing of the Declaration of Independence the United States has stood for liberty and equal rights, and each voter who enters the polling booth is claiming his privilege to take part in the government of his country. The right to vote is something that every American boy and every American girl (for the time has at last come when all women may vote) should think about very seriously, for the future welfare of our country lies in right voting, in voting for honest measures and honest men to carry out those measures. In some countries, as we have seen in the Book of Countries, failure to vote is an offence that may be punished by law. In our country the decision is left to each person. Therefore there is all the more reason why each one should accept his responsibility and appear without fail to cast his vote in favor of men who will uphold the ideals of government inherited from the men who fought for them in the War of Independence.

ARBOR DAY SET APART TO PLANT TREES FOR THE FUTURE

Arbor Day has been set aside by many states for the planting of trees and shrubs along the highways and in other places where they are needed. One purpose of this celebration is to implant in our boys and girls, our future American citizens, a love of Nature and the wonderful world about them. Another purpose is to impress the necessity of planting trees for the future.

There is no uniform date set apart for Arbor Day, as it necessarily varies in different states, owing to the differences in climate. It was first observed by the State Board of Agriculture of Nebraska, offering prizes for counties and persons planting the largest number of trees and vines throughout the state, with the result that over one million trees were planted in the first year, and over 350,000,000 trees and vines within the twelve

succeeding years. In the West there are many treeless plains and this beautiful and useful custom of planting trees at once aroused the interest of other states, and the plan was generally taken up throughout the country.

In the past, people have been wickedly wasteful in the way they have cut down the abundant forests all over our country. We are still destroying trees much faster than others grow to take their places.

The boys and girls who have kept Arbor Day year after year, planting small saplings and watching them grow inch by inch until at last they overhang the roadside, know the real value of a tree. They know it means cool, sweet air and a shady place to rest, and a beauty as straight and strong and soul-satisfying as God has ever made. Arbor Day stands for the preservation of our forests all over the land.

OTHER HOLIDAYS WHICH ARE OBSERVED IN VARIOUS PLACES

Besides the holidays already mentioned there are many other days of local importance merely, that are observed in the different states. For instance, Patriot's Day, April 19th, and Forefathers' Day, December 21st, are kept as holidays in Massachusetts and the former also in Maine; March 4th, every four years, is set aside for the Inauguration of the new President in the District of Columbia; May 20th, the anniversary of the signing of the Mecklenburg Declaration of Independence, is observed in North Carolina; March 2d, the anniversary of the Texan Independence, is celebrated in that state, while Good Friday is a holiday in some states.

LABOR DAY. THE FIRST MONDAY IN SEPTEMBER

The first Monday in September is generally observed all over the United States and Canada as "Labor's Holiday." Then the great army of workers, rich and poor alike, all over the country, put aside their tasks for a day of rest and pleasure.

Labor Day was made a holiday in the District of Columbia by Congress in 1894 and is a holiday in the same sense as Washington's Birthday or the Fourth of July. But so far as the cessation of ordinary business is concerned—the signing and falling due of notes, the lawfulness of customary transactions, and so forth, Congress has no power to create a holiday in the states. The Congressional bill makes Labor Day a legal public holiday in the District of Columbia and requires the closing of all Federal offices throughout the United States.

WORLD HOLIDAYS. NEW YEAR'S DAY, AND CHRISTMAS DAY

Both New Year's Day and Christmas are legal holidays in the United States. The old custom of making and receiving

CHRISTMAS IN MANILA

New Year's calls has almost died out, but wherever the winter climate will permit New Year's eve is celebrated with horn-blowing, fireworks and jollity. In Pasadena, California, a lovely fête of roses is given on January first, when beautiful processions pass through the gaily decorated streets, while automobiles, carriages, horses, bicycles and "floats," often having historical significance, are trimmed profusely with roses of every hue.

Christmas, as every boy and girl knows, is a most delightful day. People all over our broad land, even those who do not recognize its beautiful religious significance, unite joyously in this time of gift-giving and "good will to all mankind."

Long ago in the Puritan colonies, all exhibitions of gaiety and happiness were considered sinful and Christmas was not observed. In fact, the stern old Pilgrim Fathers made a law, forbidding any one to celebrate Christmas on pain of arrest and punishment. Now-a-days, however, Christmas is celebrated in New England just as it is everywhere else because a little Child was born in Bethlehem long ago.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 4567.

A SAFE AND SANE FOURTH

The old-fashioned Fourth of July with its firecrackers and explosions of powder became so dangerous that all over the country other forms of celebration were substituted for the noisier forms. This picture shows part of a parade of nationalities, one of the first held in New York City, where much is done to teach children born in other countries that they are Americans, and to love their adopted country.

This picture, also made in the vicinity of New York City, shows an obstacle race, which was one event in the games held in celebration of the day. The authorities in this city have forbidden the sale and discharge of fire crackers, and fireworks may be set off only by special permission given to responsible parties, but celebrations are held to impress the day, and what it means, on the minds of the children.

THE TOOTHWORT

This plant has a fleshy stem covered with tooth-like scales, and its flowers are of a dull red color. It grows among dead leaves and on the roots of trees, and spends the greater part of its life underground.

THE FIELD SCABIOUS

The pale lilac flowers of the field scabious are conspicuous in grain-fields, although they are not confined to the field, but may be seen in the hedgerow. The stem is hairy, and the leaves vary in shape.

THE COMMON CHAMOMILE

The name chamomile means ground-apple, and refers to the pleasant apple-like smell of the plant. Made into tea, it is a good remedy for indigestion, and even to lie on a bed of chamomile and inhale the odor is helpful. It belongs to the Aster family.

THE HENBANE

This hairy and unattractive plant, with its dingy yellow flowers veined with dull purple, is not a native of England, but was formerly cultivated in herb-gardens, and, escaping, became a wild flower. It has an unpleasant odor. Another name is the devil's eye.

LITTLE KNOWN BRITISH FLOWERS

CONTINUED FROM 4356

THERE are, as may be supposed, many flowering plants in Great Britain and elsewhere in Europe that here we rarely hear of, even in literature. Some of them, if sufficiently handsome, are brought overseas as garden plants; a very few become naturalized to a slight extent, and some are used medicinally. Others, while favorites with people in the Old World, are still new to us.

THE CHAMOMILE, SOURCE OF A FAMILIAR DRUG

If we lived across the Atlantic we should find that perhaps the most widely known, on account of its former extensive use as a medicine, would be the chamomile, whose little heads, made up of many minute white-rayed flowers, are plucked and dried. From them is extracted the medicine. The chamomile is also frequently cultivated as a border plant, the flowers being prettily surrounded by feathery foliage. It is a member of the aster family.

THE HENBANE THAT YIELDS A POISONOUS DRUG

The leaves of the ugly henbane, that are very poisonous, nevertheless will afford a quieting medicine, when properly treated. It belongs to the potato family, in which there are an amazing number of poisonous plants. We shall find several of them illustrated in other articles,—the thorn apple, the deadly and woody nightshades, etc. The henbane, "so called from the baneful effects of its seed upon poultry," was one of the plants that witches were supposed to use in their concoctions and ointments. It has become somewhat naturalized in waste places, so that we should remember that it is a tall plant of rank odor, with coarsely wavy-toothed leaves, sometimes nearly a foot long, hairy and gray-green. Its somewhat open, funnel-shaped corollas are greenish-yellow, covered with a network of purple veins. The capsule is enclosed in the enlarged calyx.

THE FIELD SCABIOUS, OR "DEVIL'S-BIT"

The field scabious is very like the cultivated scabious in our gardens. Dozens of little flowers are grouped in a head, but it is not a composite, as the anthers are not joined in a ring, but one of the teasel family. Although tubular at the base, the flower flares out into a sort of one-sided brim, making a convenient landing-stage on which insects may perch. The scabiouses are very rich in honey, and some are very hairy to prevent snails and unwelcome insects from crawling up on the stems to steal it. All the

Copyright, 1911, 1918, by M. Perry Mills.

flowers in a head display their anthers before the stigmas become ready to receive pollen. By this arrangement some of the pollen of each flower's anthers is likely to fall on its own pistil. It is supposed that if an insect brings pollen from some other flower it will be chosen by the pistil in preference to that of its own flower; but if not, the latter is sufficient to fertilize the seeds.

THE TOOTHWORT, WHICH LIVES CHIEFLY UNDERGROUND

One of the most curious plants that we should find, would be the toothwort, that spends most of its life underground, drawing its food from the roots of trees and shrubs, and thrusting out long, scaly shoots, but only once a year sending up into the air flower-bearing stems. These thick, fleshy stems are all white, or with a faint tinge of purple (this pallid tint being very conspicuous on the brown forest-floor), and are bowed at the top, which is covered with flowers, while the lower part is clothed in thick scales, which are all the leaves it possesses. If we dig carefully around it, and trace these stems downward, we shall find its rootlets are attached to the rootlets of the tree by swollen suckers.

The toothwort, however, is only partially a parasite. It has very complete arrangements for cross-fertilizing the flowers during their brief existence. The stigmas ripen before the anthers, and protrude from the corollas before these latter are fairly open. They can be pollinated, in this stage, by pollen from some other flower more fully developed, in which the anthers have been forced out of the corolla. The bee that brings the pollen, while seeking honey, secreted by a cushion under the base of the pistil, has been well sprinkled with pollen, fallen from anther-cells that he has forced apart during his probing of the older flower. In case no insect visits a flower, the pistil dries up, and the stamens still further elongate and push their anthers so far out, that the wind empties their pockets, and the flour-like pollen falls on some young, unshriveled pistil, further down the spike.

THE SALAD BURNET, A MEMBER OF THE ROSE TRIBE

If we should walk over parts of the downs in Southern England we might sometimes feel certain that somebody close at hand is slicing up cucumbers, owing to the odor that comes to our nostrils. A little close attention will prove that the scent arises from the spot where we are standing. If we gather one of the leaves of the plants beneath our feet we shall find that the scent is scattered because we are crushing them with our shoes.

The plant is the salad burnet, a member of the rose family, though our first sight of the flowers would never lead us to suppose it is so related. Its long, narrow leaves, which may be nearly a foot in length, lie flat on the ground, and are divided into a number of coarsely toothed oblong leaflets in pairs. From the centre of the leaf-rosette rise the flower-stalks, a foot or more high, on whose summit is a head of tiny purplish flowers without petals. The lower flowers in the cluster have stamens, the upper ones pistils, and the pollen is carried by the wind. The leaves used to be put into salads instead of cucumber.

THE SPURGE-LAUREL, WHERE THE BEES FIND FOOD

A shrub that is occasionally cultivated for its evergreen foliage, and that may be found in flower in the earliest days of the year, is the spurge-laurel, a plant that very few persons appear to know, even in districts where it is common. It seems to be passed over as a laurel or a rhododendron. It has a branching stem three or four feet high, the greater part of which is bare of leaves. These are borne only on the upper part, and are large, leathery and evergreen, oval and lance-shaped, and somewhat drooping on all sides of the stem, forming a perfect roof over the blossoms. The yellow-green flowers are produced in drooping clusters from among the leaves, and are tubular, with four spreading lobes at the mouth. They have eight stamens, a single pistil, and are sweet-scented. The early bees and butterflies know they can get refreshment in the spurge-laurel's flowers.

EUROPEAN ORCHIDS THAT GROW IN THE GROUND

There are several orchids to be found in the wood. The earliest are the twayblade, one species of which is also found in America, and the tall spotted orchis, with white flowers streaked and spotted with red or purple. Then there is the white helleborine, with pale leaves and pure white flowers that never open widely.

THE WILD MIGNONETTE

We can all recognize this bushy little plant by the resemblance of its flowers to those of the garden mignonette. It is, however, stiffer and more upright, and the perfume is not quite so fragrant.

THE COMMON CENTAURY

This neat little plant, with its pretty funnel-shaped flowers, varying in color from the usual rose-pink to the rarer white, blossoms from June to September. The flowers close at evening-time or when rain falls.

THE DWARF PLUME-THISTLE

Unlike the other thistles, this plant is practically stemless, and its solitary crimson flower nestles in the midst of a rosette of leaves. It is also called ground-thistle.

THE NARROW-LEAVED EVERLASTING PEA

This plant, with rosy-pink flowers and greyish-green sword-shaped leaves, trails or climbs over the other plants among which it grows. It makes good fodder.

THE GRASS VETCHLING

It is impossible to discover the grass vetchling, or grass pea, until it is in bloom, for it looks exactly like grass, but its bright crimson flowers are very conspicuous.

THE SALAD BURNET

The leaves of this plant taste and smell like cucumber, and, as its name implies, the plant was once used a great deal for salads. The flower-heads are reddish.

THE HEDGE-GARLIC

The smell of the hedge-garlic, or jack-by-the-hedge, is certainly not pleasant, but its clusters of white flowers are very dainty. In Wales it is often fried with bacon. When bruised the leaves give out an odor of garlic.

THE SPURGE-LAUREL

The yellow-green flowers of the spurge-laurel, that grow in clusters, change into bluish-black berries, so poisonous that quite a few are sufficient to cause death. The bark is often used to make a lotion.

THE TWAY-BLADE

Because of the two very large leaves, which are much more conspicuous than the stem with the little yellowish-green flowers, this plant received the name of tway-blade, or two-blade. It is covered with down.

THE BIRD'S-NEST ORCHIS

There is no green about the bird's-nest orchis, for stem and flowers are alike, yellow-brown. The name is given because of the interlacing of the roots. This plant looks very much like brown rape.

THE SPOTTED ORCHIS

The pyramid-like spike of lilac flowers, streaked with purple, and the lance-shaped leaves, spotted with purple, make this a noticeable plant wherever it grows, which is usually in moist meadows and woods.

THE GREATER BUTTERFLY ORCHIS

The greenish-white flowers of the greater butterfly orchis have little resemblance to a butterfly, although it is from a fancied likeness that the plant gets its name. Its pollen is carried by moths.

THE FLY-ORCHIS

This orchid grows as a slender plant a foot high, and is often passed unnoticed. It is not at all common, but its flowers, somewhat resembling a fly, are very pretty. Only two flowers are open at one time.

THE GREEN-WINGED ORCHIS

In general appearance this orchid is very much like the purple orchis, but its leaves are narrower and the flowers are darker. It blooms from April to June in meadows as far north as Northumberland.

THE LESSER BUTTERFLY ORCHIS

This is the more common butterfly orchis, the fragrant flowers of which are whiter and smaller than those of the greater butterfly orchis. It is the finest of our orchids, and is well worth the finding.

THE BEE-ORCHIS

This beautiful orchid is worthy of its name, for, while other plants have been called after various objects whose resemblance it is difficult to trace, the flower of this plant bears a startling likeness to the bee.

These are all May flowers. In June we may find the strange, leafless, bird's-nest orchis, of much larger size, with yellow-brown flowers, near the roots of the beech; and in September there is the purple helleborine with stems three feet in height.

ORCHID FLOWERS WHICH RESEMBLE INSECTS

In summer, should we come across a damp place on the wide heaths, we may find there the butterfly orchis. It has two large oblong leaves near the ground, and a stem a foot or more in height around which a crowd of whitish moths appear to be hovering. If we find them about twilight, they will look whiter and more moth-like than in the day-time. The truth is that what appear to be moths are the flowers of this orchis. Its pollen is carried by moths, and to suit their long tongues the nectar is stored in a long hollow spur that projects behind the flower. It is very likely that the appearance of the moth-like flowers attracts the real moths. When they find out their mistake, they are detained by the fragrance of the nectar.

THE BEE-ORCHIS

The downs, too, are a fine place for British wild orchids. We shall find there the beautiful bee-orchis, with its pink and white sepals and petals spread out like wings, and the broad, curved lip striped with brown to resemble a bee's body. The fine tip of it is curved underneath, and might well be the bee's sting. In some seasons this is abundant, but less so than is the fly-orchis, which has only about two flowers open at a time, and these look wonderfully like a fly with a brown body and a patch of blue on the back. The flower seems to have eyes and antennæ also.

Then there is a taller-growing kind, the green-man orchis, with many greenish flowers. A shorter kind, with green body and round head striped with red, is called the frog-orchis. A still smaller one, with dark purple and green flowers spotted with white, is called the dwarf orchis. It is very plentiful but not easily seen among the grass, unless we are really hunting for it.

Down in the meadow we shall find two kinds of orchis, the early purple orchis and the green winged orchis. Though both are much alike in growth, and both have purple flowers (sepals as well as petals being colored), the green-winged orchis has strong green lines along its sepals, which are half closed, so that, with the upper petals, they form a hood over the rest of the flower.

AN ORCHID THAT SHAKESPEARE KNEW

Into her fantastic garlands Ophelia twisted that early orchis called

> "Long-purples,
> That liberal Shepherds give a grosser name,
> But our cold maids do dead men's fingers
> call them."

In all orchids there is only one two-celled anther, and its shape is peculiar. It is joined to the style of the pistil, and with it forms what is known as the column. On the lower part of this are two stigmas, usually broad and flat, run together so as to appear like one, above which is a narrow shelf-like projection (the beak) over which is the anther. The pollen is gathered into two pear-shaped masses which stand just within the pouches of the anther, and at the lower end of each there is a sticky knob, which lies "loosely in a cup-shaped envelope" which is the above-mentioned beak, projecting like the prow of a boat at the portal of the nectary. The bees or flies or wasps use the lower petal, or lip, as a platform, and, in pushing their heads into the flower, they touch against the beak, which promptly breaks open and exposes the sticky knobs of the pollen-masses. These instantly stick to their heads, and are pulled out of their pouches when the insects retire. The remaining pollen falls over in front, where it looks like a pair of horns. When next the bees visit an orchid flower (and we know that, as far as possible, the bees keep to one kind of flower on a journey) these drooping pollinia at once strike against the stigmas, where they leave some of the pollen.

JACK-BY-THE-HEDGE, OR HEDGE-GARLIC

The Jack-by-hedge, or hedge-garlic, is a British member of the cress family. It flowers in spring close in the shelter of the hedges, as well as farther afield. In its first year it produces rather large leaves, which are sometimes mistaken for those of the violet, but they are much too round to long confuse one; when bruised, these leaves give out a strong

odor of garlic. Racemes of small white flowers spring from a tall stem, that has itself arisen from a thick root, which has been growing for a year past.

A PEA-PLANT WHICH HAS LEAVES LIKE GRASS-BLADES

In the meadow blooms the beautiful grass-pea, which has no tendrils, and no true leaves, but leaf-stalks flattened out until they resemble grass-leaves; and unless we saw the plant in flower we should pass it as a grass, especially as it grows among the grasses. But when its bright crimson flowers appear, there is no danger of mistaking it for any other plant. As a rule, there is only one flower on each long stalk. The seed-pods are flattened, and look like bent down grass blades.

PEA-BLOSSOMS WHICH FORCE BEES TO CARRY POLLEN

Another pea, the narrow-leaved everlasting pea, scrambles over the thickets, thrusting out its clusters of flowers (and, later, smooth pods), about two or three inches long, filled with little peas. This everlasting pea springs up every spring from a perennial, thick, creeping root-stock. We may find a plant that has climbed up fairly straight by means of its long, branched tendrils, reaching upwards for five or six feet. The stems appear broad and flattened, since two wings project from the main rounded portion, and reach from root to tip. Its leaves are divided into two long, sword-shaped leaflets. There are about ten flowers in every cluster, each with a rosy-red standard, or large upper petal, while the pair of wings that embrace the keel are purple.

These pea-blossoms, that are very closely allied, have a very pretty way for powdering their insect messengers. The five-petaled pea-flower has two wings and an up-starting standard that represent three petals. The other two have joined together, except for a narrow slit at the top, forming a boat-shaped pouch, called a keel, in which snugly repose the pistil and stamens, the latter partly united, and all curved upwards so that the tip of the pistil lies in the tip of the keel. When a heavy bumble-bee lights on the keel, or on the convenient wings, by an interlocking device she presses down the keel, so that instantly the pistil and stamens pop out of the slit in the keel and project far enough to tap the insect on the under side, leaving some pollen there. Moreover, there is a little brush-like affair developed in connection with the style, that sweeps out the pollen from the keel the moment the bee alights. And, of course, the stigma collects whatever pollen has been previously deposited upon the bee by another flower. As soon as the bee has flown away, the keel springs back to its former position, and thus covers the stamens.

THE PINK-FLOWERED CENTAURY, WHICH HAS TRAVELED FAR

The pink-flowered centaury is very closely allied to our pretty sabbatias, and although one would hardly suspect it, belongs to the gentian family. Its anthers twist spirally as they mature. As is also the case with the wild mignonette, the centaury is occasionally found in our waste places.

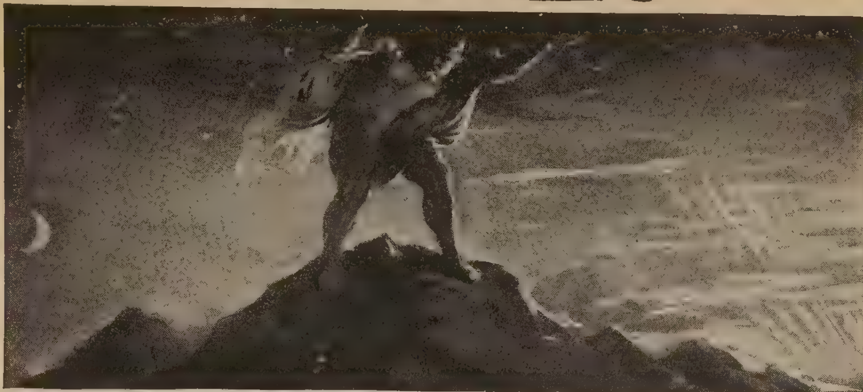
THE DWARF PLUME-THISTLE OF LEGENDARY FAME

The real Scotch thistle, that one which legend says saved Scotland from a Danish attacking party by causing one of them to shriek when he stepped on it, thus raising an alarm, has never been really identified. Certainly it would seem that the dwarf plume-thistle, cowering near the ground, might have answered the purpose. It certainly would be more easily trodden upon than the taller kinds. It probably needs its very effective armament of thorns to protect the soft flowerets and fleshy foliage from being devoured by browsing cattle.

ROSEMARY, APPROPRIATE FOR A BRIDAL

Aromatic rosemary, which we plant as a flavoring herb in our gardens, is a branching shrub of the mint family, having small leaves and flowers. It can scarcely survive our northern winters, but is evergreen in Europe, and was supposed to strengthen both the senses and memory—perhaps with its pungent odor. Therefore it served in Elizabethan times, when there was a graceful custom of expressing one's thoughts by means of flowers, as a sign to express the hope for long memory and long life. "There's rosemary, that's for remembrance," says Ophelia. Sprays of it, sometimes dipped in perfumed water, sometimes gilded, were given, with bay-leaves, to wedding guests and carried in marriage processions.

THE NEXT NATURE STORY IS ON PAGE 4557.



The people of the ancient world thought that Atlas supported the vault of heaven on his shoulders.

COULD THE SKY FALL DOWN?

CONTINUED FROM 4377

THE sky could not fall down because there is really no such object as the thing we call the sky. It often appears to us as if we lived inside a great bowl turned upside down; the sun, the moon and the stars seem to be fixed in that bowl, and to be moved round as it moves. In all ages men have had this idea, and we refer to it in such a phrase as "the heavenly sphere."

But when the movements of the heavenly bodies were more carefully studied, it was supposed that there were more spheres than one at different distances from us. In our clear climate we can get a clearer idea of the sky in the form of a great sphere than appears to men in some parts of the world.

If the sky were made like a great dome, we should indeed wonder what keeps it up. But what we see is only light reflected from the air of our own earth. The blue looks very far away, but from forty to sixty miles, at the very outside, is the greatest distance from which the light is reflected by the air to our eyes; and it is the effect of this reflection that we call the sky.

WHAT SET THE SUN ON FIRE?

The sun is not "on fire," in the same way that an ordinary fire is. We are certain of this for two reasons; first, because, at the high temperature of the sun, burning, or combustion, could not occur, curious though that at first seems, and, second, because it can be proved that the sun must long ago have burned itself out if its heat and light were obtained from burning. It is possible to reckon about how much power the sun produces, and we are bound to look to something other than burning to account for it all. The question where the sun gets its power from is most important.

Burning is out of the question; heat must be produced by the atoms striking one another as the sun shrinks under the action of its own gravitation; light and heat falling upon the sun from other stars accounts for a little; and it is now thought that probably most of the sun's power comes from inside its own atoms. And they received their power, first of all, from the Author of all the power in the universe.

ARE THERE ANY STARS IN THE HEAVENS LARGER THAN THE SUN?

This is a question which science cannot answer with certainty until it is possible to find the distance of the stars. No telescope in existence enables us to see the size of a star. We never see its disk, but only a point of light. This gives some idea of the tremendous distances of the stars.

Now, if we cannot actually measure the size of a star because we cannot see anything to measure, our only means of information is the brightness of the star. But brightness, as such, tells us nothing. The little moon is far brighter to us than all the stars put together, not because it is bigger, but because it is so very near. Therefore, if we are to learn anything about the size of any star we must first find its distance from the earth, and then compare its *apparent* brightness with its distance. From this we can judge the star's *real* brightness; and from that we may reasonably make a guess as to its size.

This is not a very certain thing, because we are only judging from brightness, and a star has very different degrees of brightness at different stages in its history, though it may be of the same size all the time. Also, we may sometimes be able to notice what power of gravitation a star has upon a near neighbor, and as we know exactly what is the law of gravitation and mass, we can measure a star's mass, though not exactly its size, in this way.

And so we find that our sun is a star of only very moderate size. The heavens are filled with many that are probably far larger. A star named Canopus, which cannot be seen from our hemisphere, is reckoned to be probably thirty thousand times as large as our sun; and there may very well be many other stars, or suns, far larger even than Canopus.

DOES THE SUN EVER MOVE?

Indeed, everything is always moving in one way or another. Galileo was imprisoned and silenced for saying that the earth moves, and now every child knows that it does. Once men thought that the sun remained perfectly still, while the planets and their moons moved round it. But we have learned that that is not true. The sun has two movements. The first is interesting, but the less important. Like the earth, the sun spins, or rotates, upon itself, and in the same direction as the earth. Thus, we can notice a sun-spot appear at one side of the sun, travel across its face, disappear for several days, and then reappear where we saw it first.

But besides this movement of rotation, the sun has a movement of translation, as it is called—that is, an actual bodily movement from place to place. We do not doubt that all the other stars are in motion too. It used to be impossible to see any sort of arrangement or order in the movements of the sun and the other stars; but lately a German astronomer, Professor Kapteyn, and others following him, seem to have shown that the stars consist of two great hosts, which are streaming through or past each other in opposite directions and at different speeds, and they think that our sun belongs to one of these groups of stars. Of course, where the sun moves he carries all his family with him—planets, moons, comets, and so on—together with every thing that is born and borne upon them. But neither astronomer nor any other scientist can yet tell us where the sun is carrying us, nor what the result will some day be.

HOW DOES A SAILOR KNOW HIS WAY WHEN IN THE MIDDLE OF THE OCEAN?

For many long centuries the sailor who ventured out of sight of land had only the stars by which to guide himself. As long as the stars are to be seen, they serve the sailor's turn. From the northern hemisphere of the earth, where we live, and where the greater number of mankind and all the great nations of the past have existed, there can always be seen, when the sky is clear, the North Star, or Polar Star, which indicates the north. Once this is known, all directions are known.

There is good reason to suppose that, as in many other cases, the Polar Star has changed its position, even within the score of centuries or so that man has observed it. It is not now due north, but apparently at one time it was so. But, as everyone knows, the sailor nowadays uses the compass.

WHY DOES A COMPASS POINT TO THE NORTH?

As we know, the compass is simply a piece of iron, balanced so that it can move freely, and made of the kind of iron which is sensitive to a magnet. Now, the earth is itself a huge magnet, having a north magnetic pole and a south magnetic pole, the latter of which was discovered by Lieutenant Shackleton on his antarctic expedition. So what we call the north pole of a magnetic needle always points to the north, or, at any rate, to the north magnetic pole, and thus

the sailor can steer his course as well as, or better than, if he went by the North Star or any other star.

The so-called north pole of the magnet should really be called the north-seeking pole, for opposite magnetic poles attract each other, and it is really the south magnetic pole of the compass needle that turns towards the north magnetic pole of the earth.

WHAT DOES MATERIALISM MEAN?

We know the words *matter* and *material;* and the word *materialism,* made from them, though it has many slightly different meanings, always means more or less the belief that matter is the all-important thing, and that mind is of less or no importance. We are all liable to be guilty, even those of us who are on our guard, of making this greatest of mistakes in one way or another; and the external difference between wisdom and folly depends not on how much a man knows, but whether he knows this.

It is materialism to worship the thing rather than what it means, or to care very much about forms and ceremonies, and to forget His words when He said: "For what shall it profit a man, if he shall gain the whole world, and lose his own soul?" or, "What shall a man give in exchange for his soul?" He also said: "The life is more than meat, and the body is more than raiment."

ARE PEOPLE MATERIALISTS TO-DAY?

Certainly, in our days, people are always making the mistake of thinking that it is enough to put notes together to make music, or words together to make poetry; that to have a voice is to be a singer; that a beautiful skin is more important than a beautiful soul; that balls and bats make a ball-player; that the ships, and not the sailors, make a navy; that an industry which brings much gold into the country is well worth while, no matter how much life it destroys; that the question of national exports has only to do with cotton and coal, and not with the sending of our best youth of both sexes to the cities or abroad, and receiving poorer specimens to the heart of the nation. All this is materialism, just like the materialism of the miser who sells his life for gold; and it will surely destroy the greatest nation as it will destroy any individual.

WILL ALL THE PEOPLE IN THE WORLD EVER SPEAK THE SAME LANGUAGE?

The answer is: Probably not. Spoken language differs very much from written language. It is surely certain, however, that some day there will be a common language which everyone will know, and which will be used for the business purposes of writing, and for speeches on occasions when people from different countries are present.

This language, whatever it is, will doubtless be based upon existing forms of speech, but it will certainly have to be a great deal better and simpler than Esperanto, or any of the artificial languages that were invented before it. The useful world language will very likely have as large a proportion of Latin in it as Esperanto has, and probably it will follow English in doing entirely without all the clumsy and unnecessary changes of gender and case and time with which older languages are burdened.

But it is a very different thing to say that all men will ever come to speak the same language. Such a notion allows nothing for invention, for local peculiarities, and for slang, which grows into regular languages in some degree. And the best proof that men will still continue to speak in their own way is to be found in what is now happening to English in the United States, in Canada, in Australia, and South Africa. There we find that the spoken language, still more than the written language, is taking its own shape; and what is spoken is, in time, written—at any rate, in the books that deal with the life of the country. It would really be a great pity if all the poetry, for instance, that is to come were going to be confined to one language, however good.

WHAT MAKES OUR TEETH CHATTER WHEN WE ARE COLD OR FRIGHTENED?

The first thing for us to do is to notice ourselves closely the next time that our teeth chatter, and to see exactly what it is that happens. We may sometimes have the opportunity of noticing what is really the same thing in other parts of our bodies; but for some reason or other the jaw is specially liable to this kind of disturbance, as we see also in the case of the disease called lockjaw or tetanus. Well, what we notice is that the muscles which close the jaw are being thrown into

a quick series of brief little contractions. When they contract the jaw rises, and after the contraction it falls by its own weight; then the next contraction comes, and so makes the chattering, the process being repeated.

When a muscle does this kind of thing, we call the act a spasm. Spasms are of two kinds: either the muscle contracts and stays so, as when the jaw is locked in lockjaw, or the spasm is in a series of little contractions, as when the jaw chatters. The great fact about all spasms, of either kind, is that they are independent of the will. We do not order the muscles to behave in this way, and we cannot stop their so behaving if they choose.

The causes of spasm and cramp, which is one kind of spasm, are very numerous, the only common fact about them all being that they act, apart from the will, upon muscles which really have no business to contract at all, except when the will commands them. Various kinds of emotion or feeling, such as fright, for instance, may cause a spasm. Cold, if not too extreme, appears to excite the ends of the nerves in muscles. A large number of poisons, such as strychnine and the germ which causes lockjaw, also have the power of causing a spasm.

HOW DID MEN FIND THAT THERE IS COAL IN THE EARTH?

The coal-measures, as they are often called, form a layer in the earth's crust which is old and has had many other layers heaped up over it since the giant ferns and other plants that gave us our coal were alive; therefore we do not expect to find coal at or near the surface.

Wind and rain, the action of the sea and other causes, not yet well understood, may rub down and wash away the surface layers in places, and then what is beneath, such as coal, may be revealed. Or sometimes there may be greater and perhaps much more sudden happenings in the earth's crust, due to the action of the heat that is imprisoned beneath it, or to the breakage of a layer owing to the increased weight of the layers above it, or due to the production of heat by means of radium and the other elements which belong to the same group.

In this way there were possibly found certain curious and easily broken black stones which, unlike all other stones, would burn. This may have happened when men were quarrying or cutting a little distance down into the earth for some other purpose. Afterwards, it was discovered how the coal lay.

We have by this time probably discovered most of the places in this country where coal can be obtained, at least for anything at all like its present cost; and when it is finished, we cannot say what is to take its place. Fortunately we have in this country such an enormous amount of water power that we can begin to save our coal.

IF WE SWING A ROPE AND THEN LEAVE IT, WHY DOES IT GO ON SWINGING?

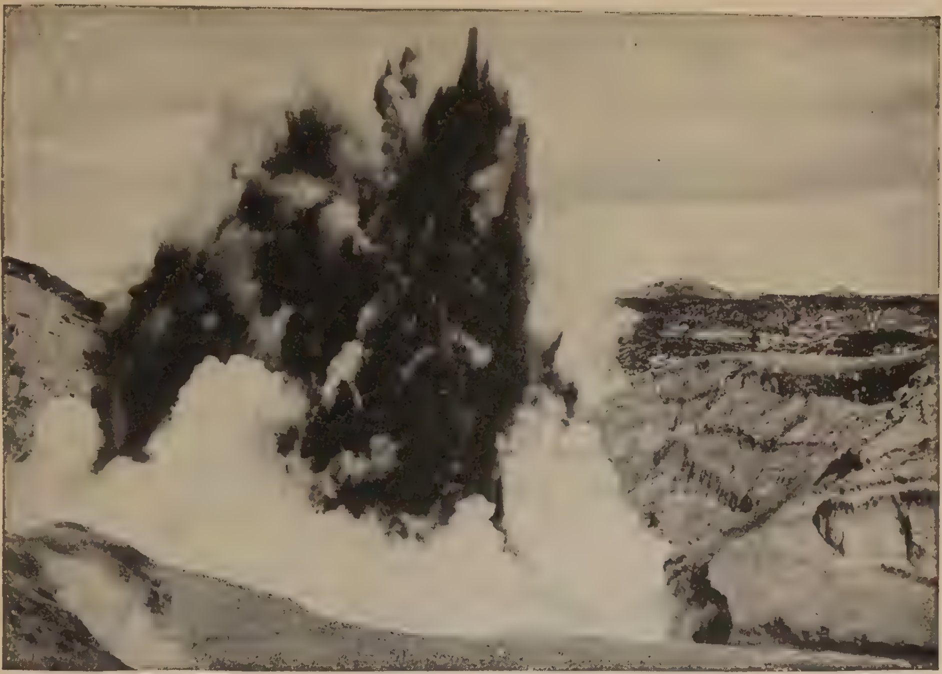
The question really might be put in this form: "Why does the rope *ever stop* swinging?" Let us see why. When we cause a rope to swing, something has happened in our muscles. A store of power, which was derived from our food, and, before that, from the sun, has been turned into motion, which is another form of power.

By catching hold of the rope at this moment we handed the motion made in our muscles over to the rope, and there it is now. Nothing is ever destroyed: and just as the chemist, working with his test-tubes, must account for every atom of matter with which he works, so in this case we must account for every particle of power and motion that is concerned. Therefore we shall naturally expect that the rope will go on swinging for ever. If it stops, the only possible reason must be that it has somehow lost its motion in doing something else.

DOES A ROPE STOP AT THE END OF EACH SWING?

It is true that at the end of each swing the rope is still for a moment before it returns, just as a pendulum is. The motion of the rope has been turned into another form of energy—the energy which may be called energy of position, or power to fall; and then the rope, by falling, turns this energy back into motion again. If we could set a rope swinging in a vacuum—a space as nearly as possible emptied of air—it would swing for a much longer time. If we could set it going in a perfect vacuum, if it were hung so that no friction was possible, and if none of its motion were used up in doing anything to the shape and struc-

MIGHTY FOUNTAINS OF BOILING WATER



Among the beauties and wonders of New Zealand are its geysers of steam and boiling water. Underground there is a great heat from volcanoes. This makes the water so hot that deep down in the earth it turns to steam and explodes, forcing the cooler water above, in brilliant and mighty torrents, high into the air.

When the steam can get away quickly, carrying the colder water above, it simply makes a great fountain; but when there is so much steam that it cannot get out fast enough, it explodes like a boiler bursting, and the result is, as we see in these two pictures of the Waimangu Geyser in New Zealand, most awe-inspiring.

ture of the strands of the rope itself, it would have to swing for ever. It would have no way of spending the motion which it could not destroy. So here is the answer to the previous question which we might have asked if we had remembered the great law that nothing is destroyed.

HOW DOES COLOR GET INTO A BUD BEFORE IT IS OPENED?

We might as well ask why it should not. The sun does not make the color of a flower directly, as if it painted the color on the petals by shining on them! Of course the life, and therefore the colors, of the plant depend upon the sun in the long run, but the color of the petals is not made in any direct way by the sun.

The plant begins in a seed, which is already constructed in a wonderful way that no one has yet been able to understand. Among the thousands of parts of the seed there are some which, though they have no color themselves, are yet able to make the colors proper to the various parts of the plant when the time comes. These things in the seed, which *determine* the future of the plant, are often called *determinants* on account of this fact.

HOW DOES THE SEED MAKE THE COLORS OF A PLANT?

Things called ferments, which may be described as tiny chemists, are probably produced in the seed, and make compounds which it is impossible to make in any other way. The right ferment starts the right process going in each part of the plant, and the final result of it all is the production of a green, a blue, a red, or a white chemical compound.

This happens because it is the nature of the plant. But without nurture the nature of no living thing can realize itself; and the nurture required by the plant when it is developing is much the same as that which it requires when it is grown up, namely, water, salts, light, and air. Light is necessary because light is power, and every chemist, even the ferment in a plant, requires power with which to work. That is why the plant produces early green leaves long before the bud begins to form, so as to be able to catch the rays of sunlight and use them to make the colors of the bud and the very substance of the bud itself.

WHERE DOES THE BREATH THAT WE BREATHE OUT GO?

Fortunately for us, the first thing that happens to the breath we breathe out is that it ascends. It does this because it is, almost always, much warmer than the air it meets, and is therefore lighter, and must rise. This means that when next we breathe in, we have unbreathed air opposite our noses, and not the used-up air we have just breathed out. This difference of temperature is the first thing that decides what happens to expired air, as the proper name for it is; but that is not all. All gases, when exposed to other gases, tend to become mixed with them, until, if nothing interferes, all the various gases are equally distributed. This very important fact about gases is called diffusion.

Expired air has much more carbon dioxide in it, and, as a rule, much more water-vapor, than has ordinary air. These gases, then, at once begin to diffuse into the air around them. But the proportion of oxygen is much higher in the air generally than in expired air, and so oxygen diffuses into it from outside. This process of mixture sounds very simple, but is very remarkable when we come to study it, for the atoms of each particular gas seem to behave as if all the other kinds of gas were not there at all, and act simply according to the number of atoms like themselves that they find around them.

Diffusion is due to the fact that gases are made up of quickly moving atoms, and these travel about to wherever there are few of themselves from wherever there are more, but take no notice of atoms of any other kind.

Another part of this question deals with what happens to the carbon dioxide of expired air. It makes food for plants, which feed on it through the tiny holes in their leaves. So we feed plants and they feed us, which is exactly as it should be.

WHY DOES HEAT CRACK WOOD?

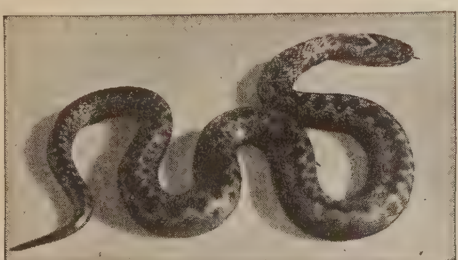
It would be easier to answer this question if more were known about the way in which matter is held together. If we knew why one end of a stick moves when the other end is moved, then we should have something to go upon; but we cannot answer even that question,

though it looks simple enough. There are two distinct problems to solve. One deals with the way in which things not made by life are held together, and the other deals with wood and other things made and built up by life. We know very little of either of these, but we know more about living things than the others. At least we can find something of their structure when we examine them under the microscope; and we can also observe what are some of the effects of heat.

There is a good deal of water in wood. Now, water occupies space, and, like other liquids, will not be squeezed. When wood is heated and the water is driven off, this means that the whole balance of forces holding the wood together must be interfered with. Another reason why wood cracks when heated may be that the heat melts and destroys certain substances which hold the fibres of the wood together.

HOW DO SNAKES MOVE ALONG?

To watch a snake or a serpent gliding smoothly and silently along the ground is to see one of the most marvelous things in natural history. Indeed, one of the wisest men who ever lived confessed that the motion of a snake was one of the things that he could not understand. Three parts of the snake's body take part in its movement—the backbone, the ribs, and the large horny scales underneath. It is by muscles which move these parts in certain ways that the snake glides along.



HOW THE SNAKE GLIDES ALONG

As a matter of fact, a snake walks on the ends of its ribs—a very curious use for ribs to be put to. These ribs are very numerous, there being one for each part of the backbone. Each rib is also fixed to one of the large belly scales. By the muscles acting on the ribs, these scales are moved forward one after the other, their edges catching the ground, and the result is a slow gliding motion. The usual motion of a snake, however, is most rapid and in this case the body wriggles from side to side, and never up and down, as is sometimes shown in pictures. It is the very flexible backbone that makes this writhing movement possible, and the structure of the backbone also allows of its being broken rather easily.

The gliding movement of a snake is really very like what happens when a boat is being rowed through the water. The ribs correspond to the oars, the ribs gripping the ground by the scales to which they are attached, just as the oars grip the water—only the snake's back is flexible, while a boat is rigid. Therefore, if we watch the snake in motion, we see the movement pass along its whole length in a wavy manner, as each rib on each side moves after the last in rapid succession.

WHY DOES STARCH STIFFEN CLOTHES?

Starch is a very curious chemical compound, with its own way of behaving. Like the proteins—white of egg, and so on—it consists of very large molecules, so large that no one knows how many atoms each one contains. It consists of molecules so big that we can scarcely say that it really dissolves, certainly not as sugar or salt, which have small molecules, dissolve. But it forms a sort of solution with water, and when the water evaporates the starch is left behind.

Starch is one of the substances that are not at all volatile—that is, able to fly off into the air. The big molecules of the starch, left behind in the clothing, form a sort of stiff layer by all holding together. We know how water affects this when we see how our collars grow limp if we perspire.

WHY DO WE NOT LAUGH WHEN WE TICKLE OURSELVES?

This is an exceedingly interesting question, because we cannot think about it without discovering a most important fact about our minds and the way in which they are made for use, for safety, and for the purposes of living. If we do not have this mighty key to mind and body, we shall never understand why it is that the same thing should make us laugh and squirm when someone else

does it, and have no effect at all when we do it ourselves. The whole point and purpose of the feeling in our skins, and of what happens—such as laughing and squirming—when this feeling is aroused in particular ways, is that it gives us information about what is not ourselves, and leads us to protect ourselves.

Our minds have so much power over the way in which our bodies reply to things that when we know the cause of the feeling to be ourselves, and therefore nothing we need concern ourselves about, the body feels no inclination to behave as it does at all other times. The results of tickling are what is called a reflex action, and we learn from this case that a reflex action is a reply to the outside world.

If it is sought to call forth the reply by what we know not to be really the outside world—as when we tickle ourselves—then the body does not trouble. This shows how reflex actions are controlled by and adjusted to the needs of the body as a whole.

DO ANIMALS DREAM AS WE DO?

As we cannot ask animals the answer to this question, we must find it out as best we can by arguing from other facts we know. The case is the same regarding babies and very small children before they can speak. But in all these instances we have quite good reason to believe that dreams occur, just as they occur among ourselves. As soon as children can tell us about themselves we find that they have dreams, and so we naturally expect that they must have dreams of some kind even sooner.

Then, as regards children, and animals too, we know that their brains or senses are made of the same principles as ours in every respect. They are exposed to the same influences as ourselves, and so it would be very curious indeed if the same results, such as dreams, did not follow from what are practically the same causes.

In dreams we have feelings of various kinds, and just as our faces largely express our feelings when we are awake, so they do when we are asleep. If we observe the ways in which such an animal as a dog, for instance, expresses its feelings when awake, we may look out to see whether it ever shows the same sort of expression when it is asleep—perhaps only for a very brief moment, but clearly, nevertheless.

We do find signs in animals which plainly show that they are having feelings of one kind or another—and that means that they are dreaming. Of course their dreams will differ from ours, just as ours differ. A musician and a painter have very different dreams, and we should expect a dog, in which the small part of the brain is very important, to dream smells, just as we dream sights and sounds.

IS PHRENOLOGY TRUE?

There is certainly nothing at all absurd in the idea of phrenology, which is that by examining the head we may tell something of the brain, and therefore something about the person to whom the brain belongs.

That is one point. But, unfortunately, there is another. The idea is reasonable but it cannot be used, because the facts of the skull and the brain are against it. To begin with, the shape of the head and the shape of the brain do not much correspond—certainly not to an extent that would be of any use for phrenology. The skull is made of bones built in two sheets, with a space between. This space is in parts very large, and is filled with air or a loose, bony tissue.

This is the way in which the "bumps" are made upon the outside of the skull. Instead of corresponding to the brain, as the phrenologists pretend, they only correspond either to air or loose, bony stuff.

DOES THE SHAPE OF THE BRAIN MEAN ANYTHING?

The fact that the shape of the head does not correspond to the shape of the brain is one fatal objection to phrenology. Another is still more serious. It is that the differences in the mere outside shape, and even in the size and weight, of brains are probably of little or no importance. The differences between brains are of very great importance, but they are to be found only in the grey matter of which the various parts consist, and in the number and shape and arrangement of the cells that compose the grey matter. These differences can be seen only when the brain is finely sliced and thoroughly and carefully examined by the microscope.

THE NEXT QUESTIONS ARE ON PAGE 4583.

THE ENGLISH GAME CROQUET

CONTINUED FROM 4388

EVERYONE knows the game of croquet as it is played in this country. The English game is played in the following manner. Along each of two parallel edges of the lawn we must mark off a length of thirty-five yards, and at right angles along each of the other two parallel edges of the lawn we must measure a length of twenty-eight yards, measuring this off, of course, from each end of the thirty-five-yards line. This will give us a rectangle, or oblong, thirty-five yards long by twenty-eight yards wide. At each of the four corners flags should be placed to mark the boundary.

Having marked out our playing space, we must now fix in the six hoops and two pegs used in the game. The simplest way of doing this is to find the centre of the twenty-eight yards boundary by measuring fourteen yards along it from either flag, and from this point measure off a distance of seven yards into the playing space at right angles to the boundary. At the end of the seven yards place one of the two pegs—either the white or turning peg, or the colored or winning peg.

Repeat this operation from the centre of the other twenty-eight-yards boundary with the remaining peg. From each peg, still continuing at right angles with the twenty-eight-yards boundaries, measure off another seven yards, and knock in a hoop at each of the two points. This will give us an imaginary centre line like the dotted line in the first diagram, thirty-five yards long, divided into five equal lengths of seven yards.

Starting from the white post and proceeding straight up to the colored post we have: the white post, the first centre hoop, the second centre hoop, and the colored post. We have now to decide the position of the corner hoops. From the white post we must measure off, right and left, a distance of seven yards parallel to the twenty-eight-yards boundary. A hoop must be placed at each of these two points. Then we repeat this from the colored post, and our croquet lawn will be complete.

If the lawn is too small to allow a playing space of thirty-five yards by twenty-eight yards, we should mark off the space as large as the lawn will allow, keeping the proportions of five to four.

Our croquet set consists of four mallets, and each is marked with a colored ring, corresponding to one of the four colors on the winning post.

One of the mallets is marked with blue, the second with red, the third with black, and the fourth with yellow.

Each of the mallets has a ball of a corresponding color; the player using the blue mallet plays with the blue ball, and so on.

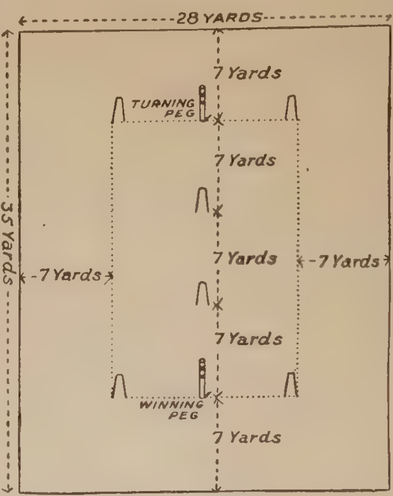
The game is played between two sides, each side, consisting of one or two players, taking alternate turns. That is to say, if there are four players the blue and black mallets shall be partners against the red and yellow mallets. The balls are played in the order marked on the colored or winning post—blue first, red second, black third, yellow fourth. This means that partners never immediately follow each other. Partner and opponent play alternately, and this order must be retained throughout the game. Should there be only two players, one takes the red and yellow balls, and one the blue and black balls, playing the colors in the proper order. Three players may have very good fun by each taking one ball and playing his own game against the other two.

The starting hoop is the one on the left-hand side of the winning peg. In opening the game the player with the blue mallet, who always starts first, plays his ball directly in front of the starting

hoop, a mallet's length from it. He then knocks his ball through the hoop, and is followed in order by the red, black, and yellow balls.

Each player then proceeds as follows: He hits his ball down the field and through the corner hoop directly facing the starting point. He then proceeds at right angles across the field past the white post without hitting it, and through the third corner hoop. Then he hits his ball up the field and through the last corner hoop in line with the winning post.

Through this last corner hoop he proceeds to the middle of the field, through the two centre hoops, and down to the white or turning peg, which he hits. He then starts upon the second half of the course by turning to the left, making for the corner hoop which was the second hoop in the first half of the game. He then proceeds back through the hoop in reverse order to the first hoop, and finishes by coming up to the winning post through the two centre hoops.



1. The croquet ground when laid out for a match, with pegs and hoops in position.

Diagram 2 shows the order of the hoops; the course to the white post being shown by a dotted line, and the course back to the winning post by a continuous line.

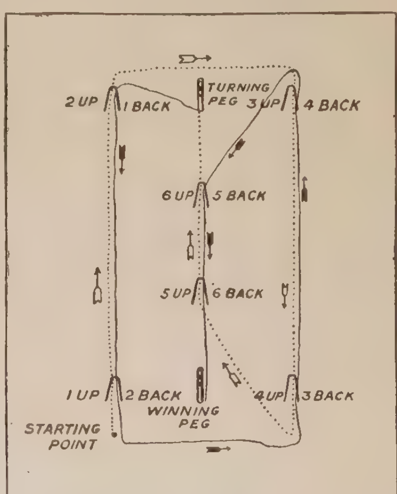
When there are two or four players, the winning side is that which gets both its balls home first. When three are playing, the winner, of course, is the player who hits the winning post first.

This is the bare outline of the game. The fun begins when we actually play, and find out how we can prevent our opponents from getting through or "running" their hoops, and how we can help our partners and assist ourselves at the expense of our opponents. It is this offensive and defensive play which makes the game so fascinating.

We must understand the following rules, however, before we can realize the full possibilities of this entertaining game.

When the player successfully runs his hoop, he is entitled to hit his ball a second time. If in taking this second stroke he hits another ball, this being termed a "roquet," he may "croquet" the ball he hits—that is, he may pick up his own ball, place it in any position touching the ball he has roqueted, and hit both his ball and the roqueted ball in any direction he desires. He then has another stroke, and if he roquets a second ball he may also croquet that, and so with the third ball. No ball must be roqueted twice before the player has made a point—that is, run a hoop or hit a peg. After a third roquet, therefore, the player proceeds down to his hoop or peg. If he fails to run the hoop or hit the peg, his turn is finished. Of course, he only roquets a ball when he thinks it is to his own advantage to do so. He may find it better to roquet no balls at all in some cases, in others to roquet one or two balls, and in others all three balls. If in running a hoop the ball hits another ball, the player who has made the point may at once croquet the ball, his one shot through the hoop counting as a roquet.

Each time the player makes a fresh point, he may roquet all the balls over again, continuing to do so as long as he makes his point regularly after every third roquet. If a player sends his ball beyond the boundary line marked by the flags, he must at once bring it back three feet inside the boundary. A player roqueting a ball beyond this three-feet limit may take his croquet, but if in doing so he sends the croqueted ball beyond the boundary, he forfeits the hit to which he is entitled after a croquet, and his turn is finished.



2. The lines show the course followed by the players from starting point to winning peg.

The roquet may be applied to our own benefit in a number of ways. For example, if our ball has rolled past a hoop without going through, we may still run it in one turn if we can roquet a ball, croquet it up in such a way as to leave our own ball in front of the hoop on the right side of it, so that we can run the hoop with the shot following the croquet.

In the same way we may croquet our partner's ball into position, being careful to remember that it is the croqueted ball and not the croqueting ball which must this time be left in position for running the hoop. If, however, neither our own ball nor that of our partner has run the hoop, it is possible to croquet both our partner's ball and our own into position with the one stroke. We should roquet our opponent away and leave ourselves in position to run a hoop.

HOW TO PLAY THE GAME OF CROQUET

The first picture shows the start, the drive to corner. The second and third pictures show how to make the forearm drive, when it is desired to keep the two balls together and make them travel for a good distance.

The first of these pictures shows how to hold the mallet and swing it for the side stroke, and the second shows the finish of this stroke. The third shows how to make a hoop, and the fourth taking croquet near a hoop.

The first picture shows making a roquet near a hoop. The second shows how to hit a ball sharply on the top to make it jump over another ball to go through the hoop, as shown by the dotted line in the third picture.

In the first picture the player is making a rush in the roquet stroke; in the second she is driving away the opponent's black ball to the difficult position marked by the black dotted circle and placing her own white ball near the hoop, as shown in the white dotted circle; the third is pegging out the opponent's ball.

A SALT-WATER AQUARIUM

THERE are few hobbies more interesting than the keeping of an aquarium, and we read on page 1739 how to make and stock a fresh-water aquarium. We should always begin with fresh-water fish and plants, as these are much easier to manage than marine creatures; but when we have had some experience with them, we can go on to form a salt-water aquarium, and certainly we shall find this even more interesting and instructive than the other. The variety is greater, and the fact that we are dealing with creatures and plants that live in the mighty ocean, and the curious form and habits of some of the inmates of a marine aquarium, all lend a vivid interest to the hobby that even the fresh-water aquarium, interesting though it may be, does not possess.

HOW TO GET SEA-WATER

In these days it is easy to get real sea-water, if you live near the coast or in a city where men sell live fish. Of course, the actual sea-water is what we shall find best for our purpose. But it is not an absolute necessity, and if there is any real difficulty, we can make artificial sea-water that will do quite well for the aquarium, and will support marine life as effectively as real sea-water.

We can buy from most druggists sea-salt in little bags, and the druggist will tell us what proportion of the salt is required to a given quantity of water. Or, if it is not easy to obtain the sea-salt ready prepared, we can get the salts separately, and make our sea-water in this way. Dissolve in a gallon of fresh water—spring or rain water for preference—the following substances: Common table-salt, 3½ ounces, and Epsom salts, ¼ ounce, both avoirdupois weight, and chloride of magnesium, 200 grains, and chloride of potassium, 40 grains, both troy weight. There are, of course, other substances in real sea-water, but these form the principal ingredients, and are quite sufficient for our purpose.

RENEWING THE WATER

The water, of course, evaporates, and the very great mistake that many people make is to renew the stock with sea-water. But in the process of evaporation only distilled water is absorbed by the atmosphere, and the various salts are left in the tank. If we fill up the aquarium with salt water from time to time, the result will be not sea-water or its equivalent, but a dense and strong brine which would kill all living things in it. We replace the evaporated water with fresh water, and if we can get clean rain-water, all the better.

In filling the tank in the first place with sea-water, it is necessary to put a mark on the glass to show how far up the water comes, then, in renewing to make up for evaporation, we shall know exactly how much fresh water to pour in, because we should keep up the fluid always at the same level. A strip of stamp-paper, stuck on the tank to mark the height at which the water stood in the first place, will prevent us making mistakes.

SEAWEEDS FOR THE AQUARIUM

Before putting in our marine creatures, we should prepare the aquarium for their reception. When the vessel is ready, we can make in a suitable place a sheltered corner, with stones or pieces of rock, and, after filling with water, we must get some seaweeds, for these help to keep the water sweet and pure. The green varieties of seaweed are the easiest to keep in an aquarium. The way to get them living is to take a chisel and hammer and chip off a suitable piece of rock with the seaweed attached.

The weed known as green leaves is the best. The rock should be placed in position in the gravel at the bottom of the tank, and in a day or two sea-bubbles will be seen round the weed. This is a proof that the seaweed has adapted itself to its new conditions of life. There are many very attractive kinds of seaweed found round our coasts that would look well in an aquarium, but unfortunately they will not live in artificial conditions, and so cannot be considered.

SEA-ANEMONES AS PETS

The most interesting creatures for our marine aquarium are sea-anemones. They may be obtained at quite a cheap price at any naturalist's shop; but, if we live at the seaside, or have a friend there, we may get them from the boatmen or fishermen of the place when we are on a holiday. It is very good fun hunting for them in the rock-pools that are found at so many places on the coast.

Six or seven varieties may easily be kept; but the hardiest of all kinds is that known as the beadlet. They attach themselves to the stones, and appear quite happy in captivity. They seem always hungry, and a small anemone in an aquarium was once seen to swallow a quarter, which cut it in two, whereupon the bottom half of the creature grew a mouth for itself and became a complete anemone, to the great astonishment of the boy who owned the aquarium.

FISH FOR THE MARINE AQUARIUM

A few of the ordinary common periwinkles may be put in the aquarium, with one or two limpets. Shrimps or prawns, too, are very interesting creatures, and they lend a fine touch of brightness to the aquarium, for their eyes glow like phosphorus, and their transparent bodies are daintily tinged with various colors.

But we must not be tempted to put any crabs into our tank, for, interesting though they may seem, they are such brigands that nothing will be safe in the water where they are.

A very common mistake made by beginners with the marine aquarium is the placing of crabs with the other creatures; but the havoc wrought by the crabs soon becomes manifest. Of course, any creatures that die, whether they be anemones, shrimps, or any other, must be removed at once, to save the water from becoming impure, owing to the decomposition of the body, which would soon be fatal to the other inmates.

Owing to the limited space which, of necessity, any private aquarium must furnish, there are not a great number of fish found round our coasts that are suitable for captivity in a tank. We cannot keep anything very large. Young sea-bass and herrings, and quaint sea-robbins, do nicely. It is often possible in cities to get small live fish of various interesting sorts at fish-dealers' stores; but one who lives by the sea can get them himself from the tide-pools The quaintest of all our seaside fishes are the pipe fishes and sea-horses, which are not scaly, but encased in an armor which is almost bony, and have mouths more like a bird's beak than a fish's lips. As to feeding these creatures, they will eat shrimps or other small sea creatures, and the anemones can be fed upon pieces of meat.

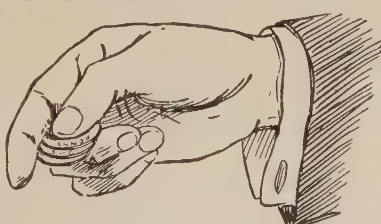
DANGERS OF OVERCROWDING

We must be very careful in starting a marine aquarium not to overstock the tank. Its capacity for fish and other creatures depends, of course, upon its size; but it is far better to have a few inmates than too many. Probably more disappointments occur through the error of overcrowding than through any other mistake that beginners make. All the rules as to cleanliness, keeping from direct sunlight, and other instructions, we may read on page 1739 in connection with the article on the care of goldfish.

CLEVER TRICKS WITH PENNIES

THE "electric penny" is a very remarkable coin, and, skilfully used, will puzzle even persons who think that they know all that there is to be known about conjuring. We shall first describe the effect of the trick for which it was specially designed, and then we shall learn how it is done.

We offer to show a trick with three pennies, but, on searching our pockets, find—or profess to find—that we have one only, so we borrow two more, and lay all three in a row on the table. We pick them up one by one, and hold them, ranged one upon the other, between the thumb and second finger of the right hand, the lower coin projecting a little beyond the middle one, and the middle one beyond the top one, forming "steps," as shown in the picture, so that there can be no doubt that all three are really there. We announce that we are going to pass one of them through the table. Placing the left hand beneath, we drop the three coins, with a quick downward jerk, on the table-top, and bring the hand down flat over them. When we again lift our hand, two coins only are to be seen; and bringing up the left hand, we produce the third penny from underneath the table.


The correct way to hold the coins.

The secret lies in the peculiar construction of the "electric penny." This is a genuine coin, but "doctored" in a very ingenious way. We need hardly say that there is no "electricity" about it, but it has been cut in half, or nearly half, by a skilled workman, and the two parts have been joined together again with tiny spring hinges made of india-rubber. The two halves may therefore be folded together like the leaves of a book, but the moment the pressure on them is removed they fly open again, and the coin becomes flat as before. The workmanship in the case of a well-made coin is perfect, so that its appearance is unaltered by the cutting, and no one, unless permitted actually to handle it, would perceive that there was anything unusual about it.

Knowing the construction of the coin we shall now have no difficulty in understanding the working of the trick. When laying the three coins on the table at the outset, we place the prepared penny at the right-hand end of the row.

In picking them up again, we begin at the opposite end. Taking the first coin, we lay it on the second and third fingers of the left hand, the tips of the fingers projecting a little beyond it. On this we lay the second borrowed penny, and on this again our own, with its *smaller* part towards the right hand. We then take, apparently, the three coins in the last-mentioned hand. In reality, however, the moment this hand touches the coins it folds down the smaller half of the prepared coin, and takes only this penny and the next one below it.

The third penny, unknown to the spectators, remains in the left hand, which holds it secure by slightly contracting the fingers on which it lies. When the two coins are dropped on the table, the spring coin resumes its normal appearance; and, as the third coin is already in the left hand, there is not much difficulty in producing it.

The young conjurer should be warned that this trick, though by no means difficult of execution, requires a considerable amount of practice in order to perform it with ease and certainty. On the other hand, it is such a good trick that it is a pity to spoil it by clumsy presentation. The cost of the "electric penny" is a few cents.

An expert in conjuring will find many other ways of using it apart from the trick we have just described. For instance, we may take a piece of cardboard six inches square, and in the centre of it cut a round hole, the size of a quarter. We lay this over the mouth of a tumbler, and say that we shall pass a penny through the hole.

We bring the mechanical penny over the hole in the card, and make a quick downward movement, at the same time folding the coin vertically between the thumb and fingers, when it will pass through and fall into the glass. The moment it has done so it unfolds, and again looks like an ordinary penny.

THE RIGHT WAY TO CLEAN THINGS

THERE is a right way and a wrong way of doing everything. From time to time many things require cleaning; our clothes may become spotted with grease, our fountain-pen may get stopped up, or perhaps we may have been walking in the rain, and so have been splashed with mud. When anything like this requires attention, the best thing is to clean the article without delay. On this page we are told the right way of cleaning several things that are in everyday use, and if we follow the directions given we shall save both time and trouble.

TO CLEAN STAINED CLOTHES

Before being brushed with a clothes-brush, dusty or muddy garments should be well shaken out of doors. It is better to let splashes of mud dry on cloth, and then remove them with a hard brush, always brushing the way of the nap. To rub the splash with a piece of the material itself before applying the brush is a good plan. A grease-spot can sometimes be taken out of cloth or silk with a few drops of eau-de-Cologne or gasolene; and when grease is dried on cotton or woolen material, it may be removed by moistening it with warm water and soaping it. Benzine is also a good grease-remover.

Another method is to place a piece of blotting-paper or porous brown paper over the spot and press a hot iron on it, moving the paper every now and then until the grease is completely absorbed. Black cloth is freshened by sponging with cold tea or ammonia diluted with water. Lay the cloth flat on a table and sponge very carefully, moistening the sponge every now and then, and hang the cloth in the air to dry. Dirt-marks can be removed by rubbing them with rag dipped in gasolene, but this fluid must not be used near a light. Ink-spots can be removed by rubbing with milk or salt. This must be done at once, otherwise the application is of no use. If the ink-spots are old, the best method is to soap them and then lay a little salts of lemon or salts of sorrel on them; but the salts must not be rubbed in, or perhaps a hole may be made in the material.

TO CLEAN TOOLS

Every tool should have its place in the tool-chest, so that its edge is not blunted by knocking against other tools. Fine tools can be rolled up in flannel to keep them bright and free from rust. Any tool can be protected from rust by greasing it; but should rust attack it we must rub it off with emery-paper.

TO CLEAN KNIVES

We can clean a dirty, greasy knife by running the blade into mold slantwise several times and wiping it with newspaper. Table-knives are cleaned in a knife-machine, or by sprinkling emery-powder on a knife-board and rubbing the blade sideways horizontally along this so that the edge of the blade is not blunted.

TO CLEAN A FOUNTAIN PEN

A fountain-pen is liable to get clogged with dried ink and hairs from the writing-paper and pen-wiper. If the pen has a movable point section, we can unscrew it, and let cold water from the faucet run through it. The pressure of the water is sufficiently strong to cleanse this part, even through a small opening. The barrel will stand a strong pressure of cold water. It is important to keep the india-rubber bulb and glass dropper rinsed out with cold water after "feeding" the pen, otherwise the ink dries in the bulb and spoils it. If our fountain-pen is a self-filling one, we can clean it properly by filling it with cold water several times and then emptying it.

TO CLEAN PAINT

Dirty painted wood should be first dusted with a dry cloth, and then washed with a soaped one. Very hot water and a hard brush spoils the paint and takes it off. We must then rinse the surface with clean water, and dry with a soft cloth.

We can remove paint from brushes by dipping them in linseed oil or turpentine, and washing them in soap and water in the palm of the hand. The soap must be rinsed out in fresh water, and the bristles shaped to a point before being stood upright to dry.

TO CLEAN DIRTY WET SHOES

If the shoes are very muddy, the mud can be wiped off with a damp cloth; cakes of it may be removed with a knife, but this needs skilful doing, lest the leather be accidentally cut. Wet shoes should not be dried before a fierce fire, for great heat impoverishes the leather. It is better to place them on their sides in a room or passage where there is a good draught. When dry, any remaining dirt can be brushed off before the shoes are blacked in the usual way for cleaning.

TO CLEAN A BICYCLE

When the bicycle is brought home wet and muddy, we should wipe the spokes and enameled parts with a cloth. Kerosene will clean the chain, and one of the numerous metal polishes will clean the nickeled parts. The chain may be brushed over with graphite or some preparation containing blacklead. Tires must be wiped clean with a wet house-flannel. The best way to clean the bearings is to run kerosene through them until the dirt has been washed out, and then to apply lubricating oil.

TO CLEAN A SPONGE

Sponges are likely to become disagreeable and slimy if used long without being cleaned. This can be done by washing the sponge in ammonia and hot water, and then leaving it for some hours to soak in cold water in which some coarse salt has been dissolved. Soaking in sea-water, its native element, freshens up a sponge. A coarse cloth is better than a sponge for the bath.

TO CLEAN BOTTLES

A glass bottle can be cleaned inside in many different ways. One way is to pour some household ammonia into it, shake it well, empty it, and rinse it clean with warm water. If the neck be wide, small pieces of a raw potato mixed with salt and water can be shaken up in the bottle, or we may use tea-leaves.

DOLLS MADE FROM CLOTHES-PINS

THE common, round clothes-pin is a convenient article to adapt so as to make tiny dolls or figures. The split end serves for legs, and the body and head are all there ready made, so that the work is simple and easy. Then clothes-pins are cheap, so that we can use a good many of them without incurring much expense, and that fact is an important consideration if we have not much pocket-money. If we prefer it, instead of making dolls we may make a small army of soldiers. A clothes-pin will not stand steadily on its legs, so we must therefore provide supports by which our dolls or soldiers may stand upright. These supports may be small pieces of cardboard, or thin wood or cord, about the size of a quarter, as seen in the pictures. A tack or two driven through the support into the bottom of the legs will serve the purpose.

Then there are many ways in which we can decorate or dress our clothes-pins, so as to make them look realistic. Black ink is the plainest form of decoration we can apply, and the first two pictures show clothes-pins finished in this way. One is a circus clown and the other is a negro with a fool's cap, which is made from a piece of paper twisted into shape. If we wish to give color to some of our dolls, we can easily do so by using our box of paints, and there is room for a display of skill even in such a simple thing as this. If we begin to put dresses on our clothes-pins, tissue-paper is at once the cheapest and easiest material to work. In pictures 3 and 4 we see a man and a woman clothes-pin dressed in tissue-paper. They look quite handsome if the work is neatly done. The man has a tall hat, which is made from a cork stuck upon the head. There are many other varieties of dress that will suggest themselves as we experiment with the pins, and it is always better to devize different styles than to copy something exactly as before. On page 938 we see how to make a pair of wrestlers from two clothes-pins, and, if we have not yet done this, we can do so after we have made a few trials with simpler figures to get used to the work.

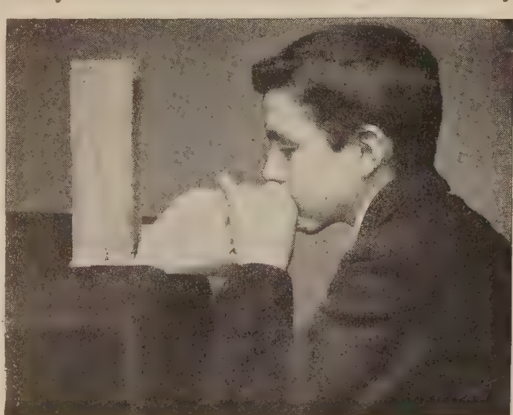
Four little dolls made from clothes-pins.

BLOWING A BRICK OVER A TABLE

SUPPOSE that we put a brick on the table and make it stand up on end, then, simply by using our breath, we try to blow it over. Of course, we shall fail. The idea of blowing a brick over seems ridiculous. But, after all, it may not be so ridiculous as it seems. Indeed, there is a way by which we can make a brick fall over simply by blowing with the mouth. All we have to do is to procure a paper bag of fairly large size, such as fruit-sellers and bakers use to wrap things in; then we set the brick, end up, on the bag near the bottom end, and, after gathering the mouth of the bag together in one hand, we blow into it sharply, as is being done in the picture, when the brick will be blown over on its side.

Of course, anything else of convenient shape, such as a large, heavy book, can be blown over in the same way. This trick is very good for an evening party, and it can be performed by a girl or a boy.

We can mystify our friends by placing the brick upon the table and then talking of the wonderful power of the wind, telling of the enormous damage it does in a storm. From this we should lead up gently to the power of the lungs, and then announce that it is possible to blow over the brick upon the table. Our friends will naturally doubt this fact; but we must persuade them to try. When they have tried and failed, we just take a paper bag and show the company present how it is done.



How the brick is blown over.

A DOILY MADE OF HAIRPIN WORK

THE lacy-looking doily seen in the picture may appear difficult to work, but it is really quite simple when the secret of making hairpin crochet gimp is understood. The doily shown is indeed a first attempt at hairpin work.

The things necessary for making it are a ball of crochet cotton, size 20, a doily centre, a crochet hook, and two metal hairpin forks, each costing a nickel. A steel crochet hook, size No. 3, should be used. If we do not understand crochet work, we should turn to page 1364.

If we intended to do very fine work, we might use a straight wire hairpin; but as it would be unwise to attempt any but fairly coarse gimp at first, we should buy two "hairpin forks," as they are called, one with a span of three-quarters of an inch between the prongs, the other with one and a half inches. The larger one is for making the wide gimp seen in the picture on either side of the narrow gimp, which is made with the smaller hairpin.

1. The hairpin fork.

First, we set about making the wide gimp. About two inches from the end of the cotton, tie a loop in it three-quarters of an inch long, just half the span of the fork. Then, taking the hairpin in the left hand, prongs upward, we put the loop over the right-hand prong. Now, with the long cotton lying over the fingers of the left hand, we turn the fork round, so that the cotton encircles the left prong. To secure it, so that it forms a loop round that left prong, we take the crochet hook and draw the cotton forwards from behind, through the loop already made on the prong now to the left, and make a chain stitch. Then we lift the handle of the hook over the prong on the right while turning the hairpin.

Next, we make a double stitch through the front part of the loop on the left. After that we turn the hairpin and draw the cotton through the loop in the hook. And we proceed like this: (1) Make a double stitch through the loop on the left—see picture 1. (2) Turn the hairpin while lifting the crochet hook over the prong. (3) Draw the cotton carefully through the loop. We continue in this way, working between the prongs, until the hairpin can hold no more loops, and we have to withdraw it.

We must take care to pickup the last two or three loops on to the prongs again to form a foundation for another hairpinful. The loops should not be so tight as to draw the points of the prongs together, for then the loops of the gimp would get smaller. To judge the quantity of gimp required, we lay it round the doily centre until we find enough has been made for the inner ring, and then fasten off the cotton by drawing it through the last loop and pulling it tight. The doily centre may need a chain of crochet worked round it to make a foundation for the loops of gimp. This was done in the case of the doily that is shown in picture 2. A row of chain is worked round that, each stitch being taken through a loop of the gimp. Some people put a circle of feather-stitch near the edge of the doily centre. It is best to tie and join the centres of the ends of gimp with needle and thread and cut off loose ends.

We next make, on the smaller hairpin, enough gimp to go round the doily. The loops of the two gimps are joined with chain stitch. Two large loops are taken into a chain stitch, then three chain crocheted, then two small loops taken into a stitch, and again three chain stitches follow. This is repeated till all the loops are crocheted in.

2. The doily as it appears when finished.

We shall now want a longer piece of the large gimp to go outside the small one. To this it is joined by crocheting three chain, then twelve chain, each through a loop of the large gimp. These twelve chain are joined into a circle by drawing the cotton through the first of them. We must next make three chain and follow that by taking two chain through two loops of the small gimp; then three chain, then two chain through two large loops; then three chain, then two chain through two small loops. These same stitches are then repeated until the circle is quite completed.

It will be seen that "doubling back" on the twelfth stitch forms a kind of scallop and gives

fullness like a frill. This part requires special care in counting the number of stitches, as, if not accurate, the scallops are uneven.

At present the outer loops of the large gimp form a looped fringe. To give the doily a neat edging we join the loose loops by crocheting three chain, then a chain through a loop, and repeat this until we come to the dip between the scallops, where the two loops are together on the opposite side of the gimp. At this point we make four chain, each stitch through a loop, then draw the cotton through the first of these four chain to make a small scallop, and proceed three chain and a chain through a loop until the next dip is reached. This we repeat until the loops are used up.

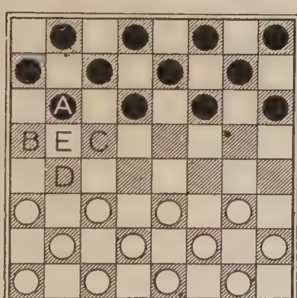
Lastly, to make the points to the edging seen in the picture, we start a chain through the middle stitch of three; make six chain; take a chain through the fourth one back to make the point; make two chain; then make one chain through the middle stitch of the three chain below. This is repeated all round the doily, giving it a durable edge, so that it can be used for a cake-dish, and will stand washing well. With a little ingenuity, pretty designs for embroidery work can be made with hairpin gimp. Treble stitch can be substituted for double stitch, and gives a solid, broad centre to it. This effect is increased by working three treble stitches into each loop.

Wool, macramé twine, silk, in fact, any thread that is generally used for crochet, will make hairpin gimp. Done in peri-lusta the gimp makes a foundation for pretty insertions and laces of various kinds. Bags, purses, shawls, and other articles can be made with hairpin gimp.

HOW TO PLAY DRAUGHTS, OR CHECKERS

THE ordinary game of checkers, unlike most amusements, is so simple that a child can learn to play it, and yet it lends itself to such careful study that men play it almost as they play chess, looking many moves ahead, and making the most wonderful combinations.

The board has 64 squares, 32 of one color, as, for example, white, and 32 of another color, such as black. There are 24 men, disks of wood or bone, 12 white and 12 black. Each player takes one of the sets of men and arranges them as in the first picture, taking care that there is a white square at the bottom right-hand corner of the board before him.

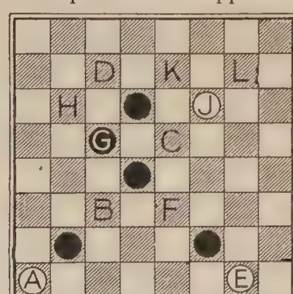


The pieces are placed on the black squares to start with, and are always played on these squares, never being moved on to the white. They are moved diagonally, that is, the man A in the picture will move to B or C, but will not leap across the white square E to D. They move forward, one square at a time, the players taking turns alternately. A man is captured by the opponent's piece leaping over him diagonally into a vacant square beyond, and the captured man is then removed from the board.

If, after leaping across an opponent's man into the next square beyond, we come next to another of our opponent's pieces with a vacant square beyond that, in either direction, we can continue our move and leap over this second piece, taking that as well as the first one. Even more men can be captured at a single move, provided each one has behind him a vacant square into which our piece can be moved.

The second picture, which is a game in course of being played, will explain the moves clearly. We can move from A to B, then to C and then to D at one move, taking three of the black pieces on the way. But from E we could move only to F; we could not go to G because it is occupied by a black piece, and we cannot leap across two pieces together and go to H. When we are not capturing the men, we move only to the next square. The white man J, for instance, in picture 2, can move only to K or L.

As soon as a man has reached one of the four squares at the opposite end of the board, he is crowned, that is, has another checker put on top of him, and becomes a king.



He can now move either backwards or forwards on the board. This is a great advantage, and sometimes five or six men may be captured by a king at one move. The object of the game is to take all our opponent's men, or so block them up that they cannot move, then we have won. When an opponent is able to take one of our men, and does not do so, we can either huff him—that is, take from the board the man with which he could have captured our piece—or we can compel him to make this move in preference to the one he has taken. Huffing does not count as our move. The choice of color is decided by lot, and black moves first. In each fresh game we change our men, playing first with black and then with white, and so on. If we touch a man, we must move that man. If we remove one of our own men from the board by mistake, we have to lose it. Usually when only two kings remain on the board a deadlock occurs, and there is no way of either player winning, except by the gross carelessness of the other; therefore, with only two kings on the board, the game is drawn.

MUSIC FROM DRINKING GLASSES

WHEN we consider that music really consists of regular wave movements passing through air or some other medium, it does not surprise us to find that if we can make sound waves vibrate through a substance like glass, we hear a musical note. Musical instruments are played by striking, plucking, rubbing, or blowing; and we can get a musical note out of a tumbler by tapping it or by rubbing it. When we rub the strings of a violin with a bow, we make the strings vibrate; and the vibrations pass off into the air in all directions, some of them reaching the drums inside our ears.

It is possible to see with our eyes how wave movement and sound are connected with each other. If we get a thin goblet or wine-glass and tap it gently with the thumb-nail or with the back of a knife, it gives out a sound that is a clear note, and which we can name by finding another like it on the piano. Now we will place the glass on a table, fill it nearly to the top with water, and hold the stem of it steady with the left hand. Then, if we moisten the second finger of the right hand with water, and rub it steadily round the rim of the glass, we shall find before long that the surface of the water is in commotion, striking the sides of the glass and giving out a clear bell-like note.

Long ago—some people think it was in the time of the ancient Egyptians, who used to make beautiful glass—someone found out that sweet notes could be obtained in this way from the rim of a glass vessel, and started experimenting. Thus the idea of playing musical glasses arose, and very beautiful music they give. For some 150 years people have enjoyed this music in Europe.

We can collect our own musical glasses; but we must make a diligent search for them, for not every glass has a true note any more than every person has a sweet voice. Ordinary drinking glasses will do, but they must be thin. Two such glasses may be made just alike, but when they are tested, as described above, by tapping with a thumb-nail or with the back of a knife, their pitch, or note, will be found quite different.

Suppose we want a glass which gives the note F, we shall possibly have to test a dozen or more glasses before we find one that gives a note anywhere near it. But even if it is not quite in tune, a little water poured into the glass will make the note lower, or lower the pitch. The reason for this is, the greater the number of vibrations per second, the higher is the pitch of the note. So we see that the water poured into the glass acts as a sort of brake on the vibrations, which have to move more slowly, and, in consequence, we get a lower note.

If we mean to have a complete set of glasses, we shall need quite thirty-three, or just over two and a half chromatic octaves of tones and semitones. This makes a "manual," such as is seen in the picture, where it will be noticed that the glasses are of different forms and sizes, placed in order in wooden trays, with partitions to steady them. One advantage in playing on glasses is that we can place the notes of the scale in the order we prefer; and though we play with both hands at once, it is more convenient for a left-handed person to be able to place the notes most used under his left hand instead of under his right, as right-handed people have them.

HOW THE MUSICAL GLASSES ARE TOUCHED SO AS TO PRODUCE A MELODY

Before attempting to touch the glasses we, must be sure that the fingers are quite clean; and, in order to harden their tips somewhat, and to improve our touch, we may dip them in a glass of water into which a few drops of lemon-juice have been poured. Then we gently and firmly rub the second finger of the right hand round the rims of the glasses in the same direction as the hands of a clock, and test all the glasses, going up the scale. At first the notes will come slowly, but with practice we shall get true, pure notes. Then we may try to pick out a tune. "The Bluebells of Scotland" or "Home, Sweet Home" are found as easily as any. As both hands can play, while one is still touching a glass, we can find the succeeding note with the other hand.

After a time, players become expert in using both hands at once, so that they can employ them in unison or in part harmony. A skilful performer starts one note before the last one has died away, and so makes delightful harmonies. With two or three sets of glasses, it is possible to play duets or trios.

Our musical glasses are very easily tuned, not that they really *need* tuning like a violin or a piano. All we have to do is to add a little water to the glass or else take some away from it, and so raise or lower the pitch.

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF OCTOBER

If we have not already made the soil suitable to receive any fruit-trees we might think of planting during the autumn, we should do so now. The work of planting can be done late in October or early in November.

We may well take great care with the actual planting of our currant-bushes or gooseberry-bushes, or whatever we may contemplate planting, as upon this depends much of their success. First of all we must bear in mind that the hole must not be too small. It does not need to be very deep, but it should be a *large* hole with a flat bottom, and the soil should have been worked and stirred a good deal deeper than the hole has to be, so that the roots may get to work quickly.

When the hole has been made ready, we take our bush and, holding it upright in the hole, spread out the roots on all sides; if there is not ample room for all these roots to lie outspread quite comfortably, we must widen the hole, as it is the placing of the roots fairly and squarely, as it were, that makes all the difference between good and careless planting.

It is best for one young gardener to hold the bush in position, and for a second one to shovel in the soil about it. This soil needs to be firmly placed about the bush, and to be carefully trodden down, for we have to remember that high winds and sharp, penetrating frosts are before us, and that the soil must therefore be so firm that our bush does not become loosened. To prevent such an occurrence, it will be well to examine the stems of the bushes during the winter from time to time to see that all is as it should be, and especially when a thaw follows a long spell of frost.

Gardeners must always remember that, whatever crop they grow, they are taking the goodness from the soil, and that on this account they must frequently give back to it what has been taken out. We do this when we put manure into the soil, or when we dig in well-decayed leaf-mold. This brings us to an important point. Now that the leaves of the trees are falling, we have at hand valuable material, and on no account should we neglect to sweep up all dead leaves and make them into a great heap.

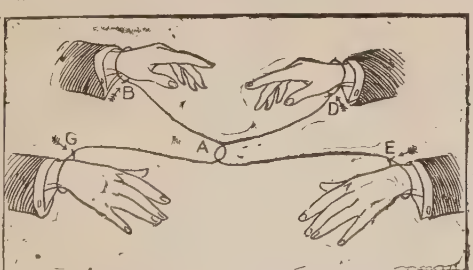
It will take a long time for this heap to decay and become the valuable leaf-mold that proves so useful; but, if we have patience, in time our leaf-mold will be produced, and we can hasten matters somewhat by mixing lime with the leaves and turning them over from time to time.

This is the time to make any alterations in the plan of our little gardens; we may build rock-gardens or make ferneries, and we may make new pathways or new beds and borders.

We may plant rose-trees or fruit-trees, and move our flowering plants. We may plant bulbs. We may lift, with plenty of soil, some plants of parsley, and plant these in a frame for winter use. If we have roses growing in pots, these may still stand out in the open—even up to November—but really tender plants should not be left out of doors after the first of October, though dahlias and gladioli and tuberoses need not be lifted from the soil until a sharp frost comes along and kills their foliage.

TYING TWO PEOPLE TOGETHER

A very amusing and perplexing trick may be played at an evening party, in which the only apparatus needed is a piece of string, that should be divided into two parts, each about a yard in length. Two of the guests are asked to come forward, and the pieces of string are tied upon their wrists in the manner shown in the picture, so that they are fastened together. What they have to do is to release themselves from one another without untying the string at any place, and, of course, without slipping the hand through the loop which has been placed around the wrist.



The prisoners tied together by the wrists.

If the two who have been tied together in this way do not know the trick, they will either very soon give it up, or they will get themselves, in a short while, into a helpless tangle. Yet it is quite simple to effect a release under the conditions named when we know the trick.

The secret is as follows: Take the string at the point A, and, making a loop, pass it through the loop on the wrist at B in the direction of the arrow. Then pass it over the hand, and the prisoners will find that they are no longer bound together, but can go free. Of course, the loop at A can be passed through the loop on the wrist at C and over that hand, and the result will be the same. Or, making the loop in the other string, we can pass it through the loops at D or E, and the partners will be loosed. This is a trick the unraveling of which is not confined to the two persons who are tied together. When they have tried to free themselves and failed, or if they know the trick, the other members of the party may be invited to release the partners. When the release has been effected, by reversing the process the prisoners may be joined up again. In trying this trick we must be careful to put the string at A through the loop on any of the wrists in the direction pointed by the arrows, or the release will not be effected.

KEEPING GUINEA-PIGS AS PETS

GUINEA-PIGS are always very interesting pets for boys and girls to keep. The proper name of the clean little pet that we know as the guinea-pig is the cavy. But we seldom speak of cavies, and nearly always of guinea-pigs. If is difficult to understand how the name of guinea-pig came to be applied to the animal. It never at any time came from Guinea, which is in Africa, nor from New Guinea, the large island north of Australia. Also it is singularly unlike a pig. The name may have been taken from Guiana, a country adjacent to Brazil, where some of the animals have been found.

The sort of hutch that serves to keep rabbits will do equally well for guinea-pigs. Their manner of life and the food that appeals to them are very much the same.

Rabbits and guinea-pigs are often kept together and do very well, but we may as well know that the reason some people give for keeping guinea-pigs with rabbits is based on an entirely false impression. It is supposed that guinea-pigs keep rats away from the rabbit-hutch, and many boys know from sad experience that rats do not hesitate to eat very young rabbits if they get the chance. Rabbits breed at the age of six months, from four to eight times a year, and the litters consist of from three to eight young.

Guinea-pigs may be purchased from any dealer in animal pets. The price paid for an ordinary short-haired pair is usually about a half dollar, or even less. Fancy guinea-pigs, such as the long-haired Peruvian breed, cost, as a rule, four or five times as much. The hut or hutch in which the pets are to stay should be warm and dry, just as for rabbits, and there should be plenty of warm bedding, such as dry hay, which should be renewed frequently, so as to keep the little house sweet and clean. The animals are very clean themselves, and the hutch should be cleaned out regularly every day. The dishes from which they feed should be washed every morning, and all scraps of food that remain uneaten should be taken away at the same time. They should also be provided with a dish of clean water.

The food of the guinea-pig is similar to that of the rabbit. They eat dandelions and fresh vegetables, roots, such as carrots and turnips, and they like bread and milk. We should give them as much food as they can eat, but if we find that they eat every particle of food that we give them, we may conclude that we have not been giving enough.

Guinea-pigs begin to have young very early, when about two months old. The young ones come in litters of three to five, and one father and mother may have about five litters in a year. It has been calculated that under the most favorable conditions one pair of guinea-pigs might increase to about a thousand in a single year.

When the young guinea-pigs come, they are pretty little creatures, well covered with fur, and with open eyes. They begin to eat the same food as their father and mother the day after they are born, and in about two months they may have young of their own. In winter the hutch with the guinea-pigs should be placed indoors, and care in regard to feeding, and attention in regard to cleaning, should never be slackened.

SOLUTIONS OF THE PUZZLE RHYMES ON PAGE 4385

SOME puzzles are given on page 4385, to which these are the answers.

The word referred to in the first verse is cataract, which is certainly a fine sight when found in the course of a river like the Nile, but is anything but pleasant as a defect of sight. The solution of the next rhyming puzzle is anemone, an *m* on *e*.

Dr. Whewell's strange-looking puzzle can be solved by remembering that O is a cipher. The lines can be read like this:

Oh, Sigh for No Cipher

You sigh for a cipher, O I sigh for you,
Sigh for no cipher, O sigh for me too.
You sigh for a cipher, I decipher so,
I sigh for no cipher, I sigh for you, too!

Of the buried names, the animals in the first stanza are: chamois, buffalo, heifer, and leopard; the eight British poets in the next stanza are: Gray, Moore, Byron, Pope, Dryden, Gay, Keats, and Hemans; and the four fruits in the last stanza are: orange, pear, date, and banana. These can all be traced easily.

The solution of the first arithmetical puzzle is written thus: $\frac{96}{6} = 16$. Two of the three nines are put upside down. In the next puzzle the answer can be given in rhyme:

Forty-five years I have seen,
When my bride was but fifteen.

This, it will be found, answers the requirements of the puzzle rhyme. In the third arithmetical problem the solution is worked out in this way. The two nines are written thus: IX NINE. Then S, which is a third of SIX, is written at the beginning and at the end, and we have SIX NINES, which is equal to 54. In the next puzzle the ages of the father and son are 42 and 14.

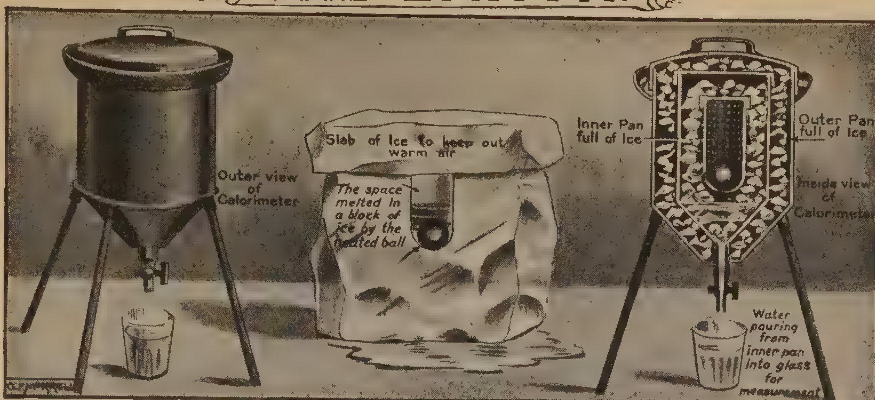
The answer to the first riddle in rhyme is POE, POET, POETRY. The T and TRY are added to the name of the American poet Poe. The thing "often talked of, never seen, ever coming, never been," and so on, is to-morrow.

The solution to the first charade is OX, ox; of the second CO, NUN, DRUM, conundrum; and of the third WEL, COME, welcome.

ANSWERS TO THE CHARACTER GAME ON PAGE 4384

ON page 4384 are some descriptions of well-known characters who are mentioned in THE BOOK OF KNOWLEDGE, and we have to guess their names from the descriptions given. These are the men and women referred to: 1. St. Francis of Assisi; 2. Oliver Cromwell; 3. Shylock; 4. Joan of Arc; 5. Miss Florence Nightingale; 6. David.

THE NEXT THINGS TO MAKE AND DO ARE ON PAGE 4613.



These pictures show the outside and inside of a simple calorimeter, an instrument that measures the quantity of heat in a thing, as a thermometer measures its level of heat, or temperature. The amount of heat is shown by the quantity of ice melted. The middle one explains how the instrument works.

HEAT AND TEMPERATURE

CONTINUED FROM 4395

THERE are very many important facts for us to learn about heat. The principal thing we have to understand is th difference between heat and temperature. The word thermometer means heat-measurer, although the thermometer does not measure the amount of heat, but only its level, just as one might measure the height of the water in something, and say it stood at such a level, without asking whether it was in a well or in the ocean. In such a case we do not concern ourselves with the amount of water; neither does the thermometer concern itself with the amount of heat. We shall see shortly how the amount of heat can really be measured, but the way to lead up to that is to study what is called *latent heat.*

The general rule is that when heat is given to a certain quantity of anything, or taken from it, its temperature changes. We might expect that this would always happen — that we could not add heat to a thing without making it hotter, or take heat from a thing without making it colder.

Yet it can very easily be proved that such is possible, and also that it does not contradict in the least the law that no kind of energy can be lost, and that all must be accounted for. If we take ice at the melting-point, and add heat to it, we do not raise its temperature; or if we take water at the freezing-point, with ever so small a piece of ice in it, we can take heat from it, and yet its temperature does not fall; or if we take a mixture of ice and water, we can add heat to it, or take heat from it, without altering its temperature. Lastly, if we take liquid water at the boiling -point in the open air, and add any amount of heat to it, not too rapidly, we make it no hotter. The liquid water disappears, and takes the form of water-vapor, which is itself no hotter than the liquid water was.

All these are illustrations of what is called latent heat. What is true of water is true of other things. Now, what we notice in every one of these illustrations is that though the temperature of the water is not changed, its state is. In one case we have ice turning into liquid water; in another, liquid water turning into ice; in another, liquid water turning into water-vapor.

Here is the proper definition of latent heat, and, though it is rather long, it is perfectly clear: "Latent heat is the quantity of heat which must be communicated to a body in

a given state in order to convert it into another state without changing its temperature." That is exactly what these examples illustrate. The heat seems to have disappeared as heat when we put it into ice and turn the ice into liquid water no hotter than the ice was, and so we say that it has become *latent*, which is a Latin word that means "lying hid."

The opposite term to latent heat is *sensible heat*. Here the word sensible is used in its proper meaning, and a thing is called sensible because it can be sensed, or felt. So, when we give heat to a thing and make it warmer, we call it sensible; but if we give heat to a thing and make it no warmer, we say that the heat becomes latent. We must clearly understand from the first that if the heat does not make the thing warmer, then it must change the state of the thing: the heat has to be accounted for in any case. We may quote the simple language in which Lord Kelvin—the great master of this subject, and such a master that he could write about it in simple words—explains to us the right meaning of the words sensible and latent heat.

THE HEAT THAT CAN BE FELT AND THE HEAT THAT CANNOT BE FELT

"Thus, when heat given to a quantity of water warms it, the heat becomes sensible to a hand held in the water. When a basin of warm water and a basin of water and ice are placed side by side, a hand dipped first in one and then in the other perceives the heat. If now the warm water be poured into the basin of ice and water, and stirred for a few seconds of time—unless there is enough of warm water to melt all the ice—the hand perceives no warmth; on the contrary, it perceives that the temperature is the same as it was in the basin of ice and water at the beginning. Thus, the heat which was sensible in the basin of warm water has ceased to be sensible in the water that was in that basin, and has not become sensible in the other. It is therefore well said to have become latent."

The facts of latent heat give us a means of measuring heat itself, for we can measure the amount of ice that can be melted into water without change of temperature, and the more ice that is so melted, the more the heat that is employed. It does not matter in what form the heat is applied; we can measure it equally well. A given quantity of ice may be melted into water of the same temperature, either by being exposed to a great deal of warmish water or to a little very hot water. But we know that in each case the amount of heat there must have been the same, because it does the same work, turning the same amount of ice into ice-cold water.

THE AMOUNT OF HEAT IN A THING IS NOT THE SAME AS ITS TEMPERATURE

The old name for heat when it was supposed to be a fluid was *caloric*, and the name for the instrument that measures heat is *calorimeter*. We must never mistake the absolute difference between a calorimeter and a thermometer; the one measures the quantity of heat, and the other measures its level.

We are, nowadays, accustomed to call a fixed quantity of heat a caloric, and that will help us to remember the word calorimeter. Of course, in ordinary language we have the word heat for both purposes. When we say latent heat, we mean heat itself; when we talk of summer heat, we do not really mean heat itself, but temperature, or heat-level.

Two great and famous Frenchmen, Laplace, the great astronomer, and Lavoisier, the chemist, whose splendid head was cut off at the Revolution, invented the first calorimeter, which measured the amount of heat by the amount of ice melted. We see a picture of this instrument on page 4501. Another method might be employed. When ice is turned into ice-cold water, heat becomes latent; but heat becomes latent also when boiling water is turned into water-vapor, and so it is possible to make a calorimeter that depends on measuring the amount of water evaporated by heat.

HOW TO MEASURE THE AMOUNT OF HEAT IN ANYTHING

We can also measure the amount of heat, without any reference to latent heat at all, by taking water or some other substance at a fixed temperature, and noticing how much a given quantity of it has its temperature raised.

When we come to consider the doctrine of latent heat in the light of our modern knowledge of matter, we see

that, though the term is worth keeping, it is rather misleading. The truth is that when ice is turned into ice-cold water by putting heat into it, the heat which disappears is really turned into something else—something else that makes the difference between liquid water and ice. This something else is the motion of the molecules of the liquid water; and what has really happened is that the heat motion has become turned into that motion upon which the liquidness of the liquid water depends.

In the same way, when boiling water is turned into water-vapor of the same temperature by having heat added to it, and when we say that the heat has become latent, what we really mean is that the heat motion has been turned into another kind of motion—the motion of the molecules making up water-vapor. We know that all gases, including water-vapor, consist of molecules in very rapid movement. Part of this we must suppose to be the special kind of movement called heat, and of this there may be less or more, because a gas may be hotter or colder.

HOW HEAT MOTIONS CHANGES INTO THE MOTION THAT MAKES STEAM

But when liquid water is turned into water-vapor of the same temperature, there is really no more heat motion in it, but the heat put into it has been turned into motion of another kind—that kind upon which depends the difference between water and water-vapor. Yet we may still retain the term latent heat as Lord Kelvin has shown us, and in all such cases as this we shall find, if we go the right way about it, that we can get back again from the substance the heat we have put into it, while it loses that special kind of motion in which the heat we put into it has been "lying hid."

Now, there is another very important phrase, *specific heat*, which we must study. If we take a given quantity of water and a given quantity of something else, both at the same temperature, and put a certain amount of heat into them, we find that the something else, whatever it is, becomes hotter than the water does. The only exception to this rule is hydrogen gas. Apart from that, it is true that, in order to make water hotter, we require to put into it more heat than into any other substance. We have to study, in the case of every substance, its behaviour in this respect, and so we learn what we call its specific heat. For convenience, we call the specific heat of water 1, and then the specific heat of all other substances, except hydrogen gas, is less than 1.

WHY THE SAME AMOUNT OF HEAT MAKES ONE THING HOTTER THAN ANOTHER

The chemists have discovered certain very remarkable laws about the specific heat of different things. It is not a matter of random chance that the same amount of heat given to the same amount of copper and iron, at the same temperature, will not raise the temperature of each of them in equal degree.

We find that there is a law in this matter, and the specific heat of a substance depends, to a great extent, upon the size and weight of the atoms of the substance. If an element has very big and heavy atoms, there will be fewer of them required to make up the given weight of that thing—say, an ounce—than will be required to make up the same weight of another element which has smaller and lighter atoms. The fewer the number of atoms, the more heat will there be, so to speak, for each of them, and so the bigger its atoms are, the more the temperature of a thing will be raised by a given amount of heat.

In other words, the bigger its atoms are, the less heat will be required to raise its temperature to a given degree. The proper way of saying this is that, as a rule, the specific heat of a thing is "inversely proportional to its atomic weight." This celebrated law is rather difficult to get hold of when first we hear it, but it applies so widely, and has such an important explanation, that we must try to understand it.

THE REASON WHY THE TEA-POT KEEPS HOT SO LONG

The very high specific heat of water has important consequences in practical life, and this is, indeed, one of the most valuable properties of this wonderful compound. If we made tea with any other liquid than water, or if we put any other liquid than water into a hot-water bottle, we should find that the tea or the hot-water bottle got cold far more quickly than usual. The fact that water has such a high specific heat

means that it will hold a lot of heat, so to speak. The amount of heat in a given quantity of boiling water is greater than that in the same quantity of anything else at the same temperature, just because its specific heat is higher. This means that if we wish to boil cold water, we have to put more heat into it than we should have to put into anything else, and it also means that when we have got the water boiled, there is a great deal of heat there, and so it takes a long time for the hot water to cool.

THE HEAT STORED UP FOR US BY WATER

All this means that water is a great storer of heat, and this fact is equally true of a full tea-pot, or a full hot-water bottle, or of the ocean round our shores. We now see more clearly than before the key to the great virtues of island climates compared with inland. The water around the islands could not do what it does if it were not for this high specific heat of water combined with its great conducting power.

This means that, in the summer, water can swallow up enormous quantities of heat, quite out of proportion, so to speak, to the extent to which it is made hotter. Nothing else could swallow up so much heat except by turning it into latent heat and becoming gaseous. These enormous stores of heat that are collected in the summer can be given back to moderate the climate in the winter; and yet the sea, though giving up such great stores of heat, is not cooled so much that it is compelled to freeze.

This must conclude our study of heat. It is a subject about which too much cannot be known, because of its immense practical importance in relation to all kinds of machinery, and the using of power for the purposes of human life; and it is a subject about which too much cannot be known, also, because of its great bearings on our ideas of the universe, and the history and destiny of things in general.

THE IMPORTANCE OF THE LAWS OF HEAT TO ALL KINDS OF MEN

There is, perhaps, no other subject in the world which so directly concerns the man who wishes to save a penny in the dollar in the working of his factory or his motor-car, or the pure philosopher who wants to know the laws and course of Nature. That is why one of the greatest of all the achievements of the nineteenth century was the discovery of the nature and laws of heat, unknown to, and misunderstood by, all preceding ages.

The discovery of these laws is of enormous daily importance to every one of us now, and it furnishes the proof of that greatest of all scientific ideas, to which science is continually bound to refer—the truth that while all things can be changed into other things, while all forms of power, such as heat, can be changed into other forms of power, yet nothing is made out of nothing, nor is anything ever detroyed. This greatest of all scientific truths, the law of the conservation of energy, was seen, as by the eye of a prophet, by the earliest thinker of whom we have any record, and has played a part in the history of the human mind for 2,500 years.

But the proof of it was not obtained until the nineteenth century after Christ, and we owe that proof to the great men in Germany and to the great Lord Kelvin, who found, in their study of the laws of heat, the fixed and eternal relations which obtained between heat and other forms of power.

THE DISCOVERY THAT HEAT AND ENERGY CAN NEVER BE LOST

We have seen that heat is not a thing in the same sense that a chair is a thing, as was once supposed to be the case, but that it is really a form of motion. The discovery that this form of motion can be changed into other forms, and that the change, in either direction, proceeds so that nothing is lost or made, was absolutely necessary if the great idea of the conservation of energy was to be proved. The fact of the equivalence, or equal value, of heat and work is now proved.

Equally important is the discovery that heat is produced by chemical changes, as in a fire, or that, in other chemical changes, heat is used up and disappears. In these cases, also, it is possible to account strictly for all the heat that seems to be made or seems to be lost. Such instances, therefore, are only a few additional proofs of the fact that in Nature it is quite impossible for anything ever to be lost.

THE NEXT PART OF THIS IS ON PAGE 4579.

Lake Titicaca, the largest lake in South America, is situated over 12,000 feet high in the Andes.

SOUTH AMERICA AND ITS CONQUERORS

CONTINUED FROM 4407

LLAMA

BEFORE we commence to read the story of South America, let us for a moment look at the map. If we study it for a little, it will add greatly to our interest, for the geography of the continent has had a great deal to do with its history.

The first thing that strikes us is the strange likeness between the southern continent and our own continent of North America. Both have the same triangular shape, both have high ranges of mountains along the western coast, both have mountains in the east and a great central plain. It is believed by geologists that more than once this central plain sank beneath the ocean, and only the mountains of Brazil and of Guiana and part of the Andes rose above the water. How many thousands or millions of years the waves of the Atlantic washed the mountains we do not know. Then the land slowly rose again, the Andes pushed their way high up toward the clouds; the low land was slowly drained, and luxurious vegetation sprang up and covered the plains.

In the northern part of the continent the Andes are divided into three distinct ranges, with high valleys between. Further south they form but two chains, or cordilleras, with a central valley, and in the extreme south they consist of one range, which ends abruptly at the southern end of the island of Tierra del Fuego. The mountains are nowhere more than fifty miles from the coast, and in fact on a clear day they are distinctly visible from the deck of a coastwise steamer. As you may read elsewhere, for over two thousand miles practically no rain falls in between the mountains and the sea. The sides of the Andes, which are the youngest mountains in the world, are very steep. Consequently the western rivers are very rapid. When the snow melts, the water rushes down in torrents to be lost in the sand or the sea, and in a short time many of the river beds are dry. In the rainless region, long stretches of the coast land are desert; and only where irrigation is possible is any vegetation to be seen except along the river beds in springtime.

Most of the rivers which rise on the eastern side of the coast range flow through the fertile mountain valleys, break their way through the eastern mountains and find their way to the

Copyright, 1918, by M. Perry Mills.

Atlantic. Therefore the valleys of the Andes and the eastern plains are well watered. The rivers have brought down enormous quantities of stuff from the mountains and deposited it on the plains, and consequently the plains are very fertile. The northern plain, especially along the great river Amazon, is covered with a thick forest of tropical trees; but the plain of Argentina is almost treeless.

When the Spanish conquerors reached South America, the country was inhabited by people whom they called Indians, and to whom the name of Indian has clung to this day. In the northern islands and on the northern coast the adventurers found the fierce and cruel Caribs, and the gentle Arawaks, whom the Caribs hated. In the highlands of Brazil the Portuguese found the Tupayas, whom the other Indians called the "ancient ones," while south of the Amazon, the great plains as far as the River Paraguay were inhabited by the Tupis. In the country that is now Paraguay and Argentina were found a people who called themselves Guaranies, and who some people say were part of the Tupi race, while others say they were a separate people. Further south toward the southern end of the continent were the Patagonians, a very tall people who called themselves the Tehuelches, and in the Archipelago of Tierra del Fuego lived a people who were even more primitive than all the others. These races were divided into many tribes, of which we shall not ask you even to try to remember the names.

Of all the people of whom we have been speaking, the most civilized were the Arawaks. They cultivated corn, and knew how to press the poisonous juices out of the root of the cassava, or manioc, to produce the substance that we know as tapioca, from which they made bread. They were good fishermen and knew how to make canoes, and to use them skilfully; but there their civilization stopped. They had no need of warm clothing, or of walled houses to keep out the cold, and they had not learned to weave, or to build anything except rough shelters.

The Tupayas never learned to cultivate the ground, and neither did the Patagonians, but the Patagonians, who lived in a cold climate, clothed themselves in the skins of the animals which they killed for food. All these people used bows and arrows in the chase, and weapons and implements made of stone.

It is interesting to know something about their lives, for the stone age still continued to exist for them and they show us how our own savage forefathers lived long ago. Besides many of their descendants continue to live in much the same way. As you may see from the map, much of the country lies within the tropics. Life down there is so easy that they have never had to learn to think, and consequently they have never become anything but grown-up children.

The people who lived in the mountain regions of the west also used stone weapons, but they had reached a much higher stage of civilization, and the stories of the Araucanians, the Chibchas and the Empire of Peru read like a strange romance.

THE ARAUCANIANS, WHOM THE SPANIARDS COULD NOT SUBDUE

Down in the southern part of the continent, where the Andes divide into two ranges, the Araucanians lived in the long central plain between the mountains. They knew something of agriculture, but supported themselves chiefly by hunting, and they are now almost a nomadic people. Nevertheless, when the Spaniards first met them, they already had a settled form of government by chiefs and princes. Their territory was divided into four independent sections, which for the sake of convenience we may call principalities, the chiefs of which were called toques. Each of the principalities was divided into five provinces, and each province was again subdivided into nine districts. The chieftainship of all these divisions was hereditary, each chief being succeeded by his eldest son. It is said that assemblies of the chiefs were held every year, and that the decisions which they made were submitted to the people of the tribes for approval. Up in the north of the continent, where the Andes break into a number of ranges, the Chibchas had already learned how to weave, how to build houses and to till the ground. They cultivated maize and potatoes and watered their fields by a good system of irrigation. The territory in which they lived was divided into five states, which were governed by chiefs called caciques. The people worshiped the sun and the moon, and as they believed that the caciques were descended from

THE CONTINENT OF SOUTH AMERICA

The continent of South America contains more than seven and a half millions of square miles, and the whole of this vast expanse of the earth's surface was at one time divided between Spain and Portugal. The long line of the Andes Mountains runs from north to south, like a great dividing wall between east and west.

the sun, they paid them great honor. They believed in other gods also, and thought that these gods were pleased with human sacrifices. The lakes, they thought, were the abodes of the gods, and offerings of gold and jewels were thrown into them, or buried on the shore.

HOW THE EMPIRE OF THE INCAS BEGAN

The cool, well-watered valleys of Peru were the home of a civilization that has been a wonder of the world since it was first brought by the Spaniards to the attention of Europeans. Its history may have gone back many hundreds of years, but all we know with certainty is told in traditions handed down from a few centuries before Spanish times. Perhaps a little later than the Norman Conquest of England, these valleys were conquered by a neighboring people, who settled there, formed a confederacy of tribes under a prince called the Inca, and built the city of Cuzco. They lived in peace for some centuries before some southern tribes, called the Chancas, looked on the valleys with envious eyes and advanced to conquer them. The Inca, who was aged, ran away, followed by most of his people. But his young son Cusi, aided by two aged generals and a few of the chiefs, gathered together a small force of seven hundred men. By skilful use of his little army, Cusi contrived to throw the enemy into confusion. When they saw what he had done, other chiefs, who were watching from the hills, came to his aid, and the Chanca chiefs were utterly routed. Then followed a war in which the Chanca tribes were conquered, and their land added to the Inca's territories, and Cusi was made Inca with the name of Pachacuti. Conquest usually leads to conquest. Pachacuti and his successors subdued tribe after tribe, until, at the time of the Spanish discovery, the Empire of Peru stretched from the land of the Chibchas in the north, to the land of the Araucanians in the south. Its western boundary was the Pacific Ocean, and on the east it extended in some places down to the forests on the great eastern plain. This empire had one of the most remarkable governments that the world has ever seen. All the conquered people belonged to the same race and had the same ideas, the same habits of thought and ways of life. Their various dialects were derived from the same language, and most of them had traditions which pointed back to the same ancestors. The Inca Pachacuti, who was the greatest man ever produced by the native American people, worked upon these materials with the skill of a great statesman, and his example was followed by the men who came after him.

No attempt was made to overthrow the customs of the conquered tribes, and the empire was built up on the idea of the village community. No one owned any property; everything belonged to the state. Marriages were arranged by the officers of the state, together with the housing, food and clothing, the games, festivals and work of the people.

Men and women of sixty had no work to do; those from fifty to sixty did only a little light work. Most of the labor was performed by men and women from twenty-five to fifty. Youths worked in the field picking coca, and children did light work at harvest time. The people were arranged in communities of a hundred families, called pachecas. Over each pacheca was an officer called a llacta-camayoc, and ten pachecas formed a huaranaca, governed by a chief chosen from the llacta-camayocs. Each valley comprised a district called a hunu, presided over by a curaca or judge. Over all, an imperial officer and staff watched every detail of the administration. Inspectors from the capital examined and reported upon the state of affairs in each district, arranged the marriages, and selected those worthy of helping in the government.

From one point of view the system was the most perfect form of government realized on earth. Nobody in the empire was poor or idle. The noble class had the hardest training, and were exposed to greatest danger; the laboring class were better off than millions of persons are in our own country. Everything in the empire was splendidly organized.

For instance, the Peruvian Indians were very fond of plays, and the state encouraged scholars to write fine dramas for the people. One of these, composed in the fifteenth century, has come down to us in the Inca language. It is a beautiful, vivid, and exciting play, equal to anything that had appeared in modern Europe at the time it was composed. They had made some progress in science and engineering.

THE PEOPLE OF SOUTH AMERICA

An Indian of Cuzco, the ancient capital of the Incas, going home with a bundle of fuel which he has gathered.

Indians of the Titicaca region of Bolivia dressed in strange costumes ready to perform a native dance on a festival. These dresses were intended to frighten away evil spirits.

An Indian woman of La Paz, in Uruguay. This is the way in which the women of those parts carry young children.

This shows a native Indian milkman of Brazil. In the rural parts the milkmen ride about on horseback.

The Patagonians, though very muscular and able to walk long distances, fall easy victims to disease. They are one of the tallest races on the earth. Here we see a woman and children wearing skins.

A native of Villa de Cura, a city of Venezuela, that suffered terribly from a great earthquake in 1900.

Botocudo Indians of Brazil, a race that lives in the wilder parts of the country. They have very primitive habits, wear few clothes, and use bows and arrows.

A group of llamas in Peru with an Indian driver. These animals are the principal beasts of burden in the country, and can carry loads a long distance.

The photograph of llamas with their Indian driver, copyright by Underwood & Underwood, N. Y.

They knew how many days made up a year; they knew how to divide the days into months, and could tell the time of the equinoxes with accuracy. They could build roads and bridges, and knew the principle of suspension bridges, and they had a truly wonderful system of irrigation. Steep mountains were terraced high up their sides, and with the aid of water from irrigation channels were brought to a high state of cultivation. The people were good agriculturists, and cultivated maize, potatoes, tomatoes, coca and cacao—our cocoa—besides other plants that are not familiar to us.

THE INCAS NEVER LEARNED TO WRITE

No South American people ever invented an alphabet, and although the Peruvians had a well-developed language, and were able to use it in composing plays and songs and poems, they had no means of writing them down. Their only mode of making records of any kind was an elaborate system of knotted cords, called quipus, but these were only an aid to memory and had to be translated by learned men, called auipucamayos. Still, all things considered, the men of the Inca empire ranked high in intellect.

Until quite lately it was thought that it was the Incas and the tribes to which they belonged who had created the great civilization of the empire. Students now see, however, that this is not so. We know that the beginning of the empire dated back only a few hundred years before the Spanish conquest, and engineers say that it must have taken thousands of years to build up the system of irrigation that exists through the mountain region, and along hundreds of miles of the dry coast region. It is said also that it must have taken many hundreds of years to domesticate the llama, which the Peruvians used as a beast of burden. This was the only domestic animal in South America when the Indians went there.

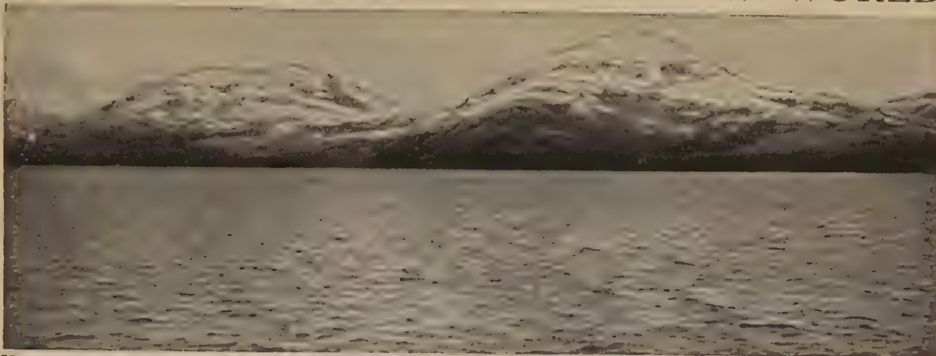
The great work that the Incas had done was to organize the people that they conquered, into an empire. They succeeded in what they attempted, but in their success the seed of failure was planted. They did not recognize that if a state is to remain great, its people must have liberty and freedom, and must have the right, and feel the need to struggle for themselves and all they hold dear. Everything was done for the people. For generations they had been taught to look to the state to supply all their needs. Consequently, when their leaders were taken, they were like sheep without a shepherd. The civilization which the Spaniards sought to impose on them was foreign to their minds, and in the centuries since the conquest, they have sunk into poverty and fallen into a state almost of barbarism.

DISCOVERY OF THE INCAS BY THE SPANISH, AND THEIR CONQUEST

Soon after they had settled themselves on the western coast of Panama, the Spaniards began to hear rumors of an empire to the south, where great stores of gold were to be found. Francisco Pizarro, one of the adventurers who had come out from Spain, believed these tales, and with the help of two friends, Diego del Almagro and a priest named Hernando de Luques, decided to go and search for the land of gold. Pizarro and Almagro had very little money, but de Luques had a small fortune, which he lent to his friends and also used his influence to obtain help for them from the government. In the year 1524, Pizarro set out to find the "land of gold" which he had heard of, but it was three years before, after many tribulations, he reached the Gulf of Guayaquil. There he made friends with the natives, and the stories which they told him, and the gold that he saw, decided him to return to Spain and get full powers of conquest from the government. This he did. He himself was appointed a governor of any new countries that he might conquer. Almagro was made commandant, and de Luques was appointed bishop of the new province that was to be added to the Spanish possessions.

Pizarro came back to the New World with his new commission in his pocket, and presently he and his two friends set out with about two hundred men to conquer an empire. At Tumbez, on the Gulf of Guayaquil, they heard that Huascar and Atahuallpa, sons of the Inca who had just died, were at war with each other for the empire. Pizarro determined to take advantage of the divisions in the country, and with 168 men he set out to look for Atahuallpa. The little band of soldiers climbed through the mountains to the town of Cajamarca. The Inca came to meet them with a large number

NATURE'S MAJESTY IN THE NEW WORLD



Here we see the strait of Magellan, between the southern point of South America and the island of Tierra del Fuego. It was discovered by Magellan, in 1520, when he sailed the first voyage ever made round the world.

The Amazon is the greatest river in the world, and its name is from a native word meaning boat-destroyer. It is more than 3,000 miles long and 50 miles wide at its mouth, and its fresh water rushes out 200 miles into the sea. Here we see the mighty river where it starts as a tiny stream away up in the Andes.

Nature provides some majestic scenery in South America. Mountain and river are at their grandest in this vast land, and here we see a wonderful waterfall in the Argentine Republic known as the Iguassu Falls.

of unarmed followers, whom the Spaniards attacked, as you may read on page 2223, and the Inca was made prisoner. The Spaniards demanded a great sum for the Inca's release, but after part of it was paid, Pizarro had him tried for pretended treason, and put him to death. After that Pizarro made himself master of most of the western country, defeated a Peruvian army at the sacred city of Cuzco and made it a Spanish colony, and Almagro conquered the provinces round about Lake Titicaca. But when Almagro attacked the Araucanians to the south, he found he had to deal with an enemy far stronger than he had hitherto met, and he was unable to conquer these fierce tribes, whom the Incas before him had been unable to subdue. The Spaniards tried for two hundred years to bring the Araucanians into subjection, but failed, and finally had to recognize them as independent tribes. It was only in the last century that they were brought under the rule of Chile. Shortly after the conquest of Peru by Pizarro, an adventurer named Quesada advanced up the Magdalena from the north, conquered the Chibchas, slew the princes and enslaved the people. Their civilization was lost, and it is only recently that we have learned that they were almost as far advanced as the people of the Empire of Peru.

COLONIZATION BY SPAIN AND PORTUGAL IN NORTH AND EAST

The wild tribes of the north could make no stand against the trained soldiers of Spain, and fortified places were established along the coast of Venezuela without opposition.

In the east of the continent, the Portuguese established their claim to the coast from the Orinoco to the Rio de la Plata. The history of their settlements belongs to the history of Brazil, and you may read it in the story of that country in another place in the book.

Buenos Aires was first founded in 1535 by Pedro de Mendoza, who had a commission from the king to establish colonies in the south. Mendoza himself sailed for Spain only to die on the voyage home. His followers found it impossible to hold the fort against the hostile Indians, so they sailed further up the river and founded Asuncion, but later on Buenos Aires was again established.

LAWS MADE TO PROTECT THE INDIANS

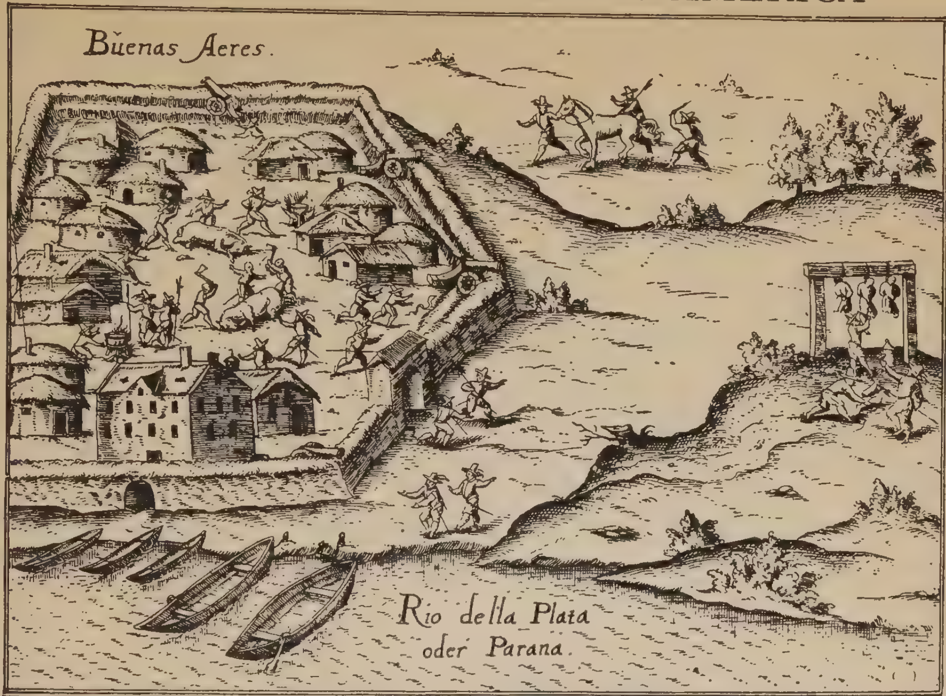
The Indians were never definitely enslaved, and in fact humane laws were made for their treatment. But the governors, soldiers and colonists were far away from Spain. They desired to have laborers to work in the mines, to build the cities and to cultivate the farms. The Indians were forced to work, too often under the lash, in the mines and on the estates. Numbers of them were practically reduced to slavery and gradually the Inca civilization was forgotten.

The clergy pitied the Indians and sought to shield them from hardship. Every effort was made to teach Christianity to them, and in time most of the old Peruvian people became Christians. The fierce Araucanians, however, refused to have missionaries, and most of the tribes of the eastern plains and forests could not be reached. This was not the fault of the missionaries, and the Jesuits in particular did all that men could do to teach these wild tribes. Their most famous mission was in the province which is now the republic of Paraguay, where they gathered large numbers of the Guarani Indians into village communities. For these villages the Jesuits adopted something like the government established by the Incas. The villagers were taught to sow and reap. They were taught Christianity, cleanliness and industry. There were large schools for the children, and the youths were trained as soldiers, so that they might defend themselves against slave traders from Brazil. But they were treated as children. No effort was made to teach them to be self-dependent, and when the Jesuits were expelled in 1768, most of the Guaranis wandered away.

COLONIAL GOVERNMENT BY SPAIN

One of the hard and fast rules laid down for the government of the Spanish American colonies was that no one who was not a Spaniard should be permitted to trade with the colonies, and that the colonies should not send their exports direct to any foreign country. For over fifty years the government was able to keep foreigners away. Then the spirit of enterprise awoke in England, and the great adventurers Hawkins and Drake began their raids on the Spanish Islands and the Spanish Main, as the northern main-

EARLY DAYS IN SPANISH AMERICA



Buenos Ayres, the capital of Argentina, was first settled by Don Pedro de Mendoza, in 1535, who also founded Asuncion in Paraguay. The settlers were driven away by the Indians and it was not until 1542 that the Spaniards were able to make a permanent settlement. This is an old picture of the fort, built by Mendoza, which was destroyed by the Indians. Buenos Ayres means good airs.

This is a picture of a troop of Araucanians advancing through the woods to attack their enemies. These fierce people were never conquered by the Spaniards, and it was not until 1870 that they acknowledged themselves a part of the Chilean nation. Except that they have herds of cattle, they have made little progress since they first came in contact with white men. They make good soldiers, however.

land was then called. Their example was followed by French and Dutch adventurers, and there was an immense amount of smuggling done, of which the colonists were glad to take advantage, for the restrictions of trade fell hard upon them. Not only were they not allowed to trade with any foreign country, but all the trade with Spain had to go through the port of Seville, and the colonies were not allowed to trade with one another. Once a year fleets of ships gathered at Seville and Cadiz, were laden with goods for the colonies, and sailed under convoy to the west. All the goods for the west and south were carried across the Isthmus of Panama on the backs of mules or Indians, and were shipped again on the other side for the towns on the Pacific Coast. For the return voyage the ships gathered at Havana and sailed for Seville, laden with the produce of the northern provinces, while the well-armed galleons carried the gold and silver and precious stones. During the times of Queen Elizabeth, the fleet was lucky if it escaped the loss of the treasure ships, and after James I made peace with Spain, the buccaneers, of whom we read elsewhere, made themselves a terror on the high seas.

For over two hundred years, all of Spanish South America, except Venezuela, was ruled from Lima, the capital of Peru, where the viceroy or king's representative lived. There were no assemblies, for Spain was an absolute monarchy, and the colonies were looked upon as the king's domains. The laws for the colonies were made by the king, with the assistance of the Council for the Indies. The country was divided into provinces and districts, presided over by governors and magistrates, who endeavored to carry out the king's law. Questions in dispute had to be referred to Lima, and you can imagine the vexatious delays that occurred when letters and reports had to be sent from Buenos Aires or Asuncion and carried over the mountains. In 1739, however, the northwestern part of Peru was made into a viceroyalty called New Granada, and in 1776 another viceroy was appointed for the provinces from Bolivia eastward to the Atlantic.

No native born American, even though he was of pure Spanish descent, could hope to gain high office, for the governor and high officials in both the state and the army were sent from Spain. These officials looked down on the creoles, or Americans of Spanish descent, and the pride of the creoles found it hard to bear their disdain. Education, of course, was in the hands of the Church. There were schools for boys and girls, and colleges for the young men; and often the children of wealthy parents were sent to Europe for education. On the whole, however, the government thought it better that the people should not learn much, and education was discouraged.

THE WAR OF INDEPENDENCE, AND ITS CAUSE

There was a good deal of dissatisfaction in the colonies over the restrictions in trade and education, the lack of self-government, and what often amounted to tyranny by the governors. After the Revolution in North America, the unrest became stronger, and it was helped by the years of the Napoleonic Wars in Europe, during which there was little communication between the two continents.

The feeling of unrest became greater when Napoleon declared his own brother king of Spain in place of Ferdinand VII, whom he deposed. Little revolts against the Spanish officials began to break out all over the country, and in 1810 they flamed into rebellion. In May of 1810, Argentina revolted. July of the same year saw Venezuela in rebellion. New Granada had already declared itself a republic, and Chile soon joined. Years of warfare followed, but the colonists were in the end victorious, and the great Spanish dominion broke up.

The great leaders in the war of independence were Simon Bolivar in Venezuela, José de San Martin in Argentina and Bernardo O'Higgins in Chile. Bolivar, who is called "The Liberator," freed Venezuela, Colombia and Ecuador from Spanish dominion. O'Higgins was chiefly instrumental in winning the independence of Chile, while San Martin not only defeated the Spanish armies in Argentina, but brought an army to Peru and defeated them there. Spanish rule lasted longer in Peru than elsewhere; but finally Bolivar, who had been made president of Colombia, led an army into the north. In December, of 1824, the viceroy was taken prisoner by General Sucre, one of Bolivar's generals, and the three centuries of Spanish rule were over.

THE NEXT STORY OF COUNTRIES IS ON PAGE 4603.

LORD MACAULAY'S UNFINISHED POEM

We have already read on page 1403 one of the finest of Lord Macaulay's "Lays of Ancient Rome," and we can remember the splendid martial strain of his poetry. In the following fragment of what would have been a long and thrilling poem had he lived to complete it, he celebrates in the same spirited style an episode in the history of Great Britain quite as worthy to be remembered in poetry as any of the great events of ancient Rome. The phrase in the twenty-second line about "treading the gay Lilies down" refers to the lilies which are the royal emblem of France, and "semper eadem," in the thirtieth line, is the Latin for "ever the same."

THE SPANISH ARMADA

CONTINUED FROM 4424

Attend all ye who list to hear our noble England's praise;
I tell of the thrice famous deeds she wrought in ancient days,
When that great fleet invincible against her bore in vain
The richest spoils of Mexico, the stoutest hearts of Spain.

It was about the lovely close of a warm summer day,
There came a gallant merchant-ship full sail to Plymouth Bay;
Her crew hath seen Castile's black fleet beyond Aurigny's isle,
At earliest twilight, on the waves lie heaving many a mile;
At sunrise she escaped their van, by God's especial grace;
And the tall Pinta, till the noon, had held her close in chase.
Forwith a guard at every gun was placed along the wall;
The beacon blazed upon the roof of Edgecumbe's lofty hall;
Many a light fishing-bark put out to pry along the coast;
And with loose rein and bloody spur rode inland many a post.
With his white hair unbonnet'd the stout old sheriff comes;
Behind him march the halberdiers, before him sound the drums.
His yeomen, round the market-cross, make clear an ample space,
For there behoves him to set up the standard of Her Grace.
And haughtily the trumpets peal, and gaily dance the bells,
As slow upon the labouring wind the royal blazon swells.
Look how the Lion of the sea lifts up his ancient crown,
And underneath his deadly paw treads the gay Lilies down.
So stalk'd he when he turn'd to flight on that famed Picard field
Bohemia's plume, and Genoa's bow, and Cæsar's eagle shield:
So glared he when at Agincourt in wrath he turn'd to bay,
And crush'd and torn beneath his claws the princely hunters lay.
Ho! strike the flag-staff deep, Sir Knight; ho! scatterflowers, fairmaids:
Ho! gunners, fire a loud salute: ho! gallants, draw your blades;
Thou sun, shine on her joyously—ye breezes waft her wide;
Our glorious SEMPER EADEM—the banner of our pride.
The freshening breeze of eve unfurl'd that banner's massy fold,
The parting gleam of sunshine kiss'd that haughty scroll of gold;
Night sank upon the dusky beach, and on the purple sea—
Such night in England ne'er had been, nor e'er again shall be.
From Eddystone to Berwick bounds, from Lynn to Milford Bay,
That time of slumber was as bright and busy as the day;
For swift to east and swift to west the ghastly war-flame spread;
High on Saint Michael's Mount it shone—it shone on Beachy Head.
Far on the deep the Spaniard saw, along each southern shire,
Cape beyond cape, in endless range, those twinkling points of fire;
The fisher left his skiff to rock on Tamar's glittering waves,
The rugged miners pour'd to war from Mendip's sunless caves.
O'er Longleat's towers, o'er Cranbourne's oaks, the fiery herald flew;
He roused the shepherds of Stonehenge, the rangers of Beaulieu.
Right sharp and quick the bells all night rang out from Bristol town,
And ere the day three hundred horse had met on Clifton Down;
The sentinel on Whitehall-gate look'd forth into the night,
And saw o'erhanging Richmond Hill, the streak of blood-red light.
Then bugle's note and cannon's roar the death-like silence broke,
And with one start, and with one cry, the royal city woke.
At once on all her stately gates arose the answering fires;
At once the wild alarum clash'd from all her reeling spires;
From all the batteries of the Tower peal'd loud the voice of fear;

And all the thousand masts of Thames sent back a louder cheer;
And from the furthest wards was heard the rush of hurrying feet,
And the broad streams of pikes and flags rush'd down each roaring street.
And broader still became the blaze, and louder still the din,
As fast from every village round the horse came spurring in;
And eastward straight, from wild Blackheath, the warlike errand went,
And roused in many an ancient hall the gallant squires of Kent.
Southward from Surrey's pleasant hills flew those bright couriers forth;
High on bleak Hampstead's swarthy moor they started for the North.
And on, and on, without a pause, untired they bounded still,
All night from tower to tower they sprang; they sprang from hill to hill;
Till the proud Peak unfurl'd the flag o'er Darwin's rocky dales,
Till like volcanoes flared to heaven the stormy hills of Wales,
Till twelve fair counties saw the blaze on Malvern's lonely height,
Till streamed in crimson on the wind the Wrekin's crest of light,
Till broad and fierce the star came forth on Ely's stately fane,
And tower and hamlet rose in arms o'er all the boundless plain;
Till Belvoir's lordly terraces the sign to Lincoln sent,
And Lincoln sped the message on o'er the wide vale of Trent;
Till Skiddaw saw the fire that burn'd on Gaunt's embattled pile,
And the red glare on Skiddaw roused the burghers of Carlisle.

HUNTING SONG

The author of this very famous hunting song is unknown, but he was certainly a true poet and a lover of the chase, for his lively verses breathe the very spirit of England's time-honored sport. The song is evidently of the time of Henry VIII.

THE hunt is up, the hunt is up,
And it is well nigh day;
And Harry our king is gone hunting
To bring his deer to bay.

The east is bright with morning light,
And darkness it is fled;
And the merry horn wakes up the morn
To leave his idle bed.

Behold the skies with golden dyes
Are glowing all around;
The grass is green, and so are the treen
All laughing at the sound.

The horses snort to be at sport,
The dogs are running free,
The woods rejoice at the merry noise
Of hey tantara tee ree!

The sun is glad to see us clad
All in our lusty green,
And smiles in the sky as he riseth high
To see and to be seen.

Awake all men I say again,
Be merry as you may;
For Harry our king is gone hunting
To bring his deer to bay.

TO A MOUNTAIN DAISY

This beautiful poem, by the great Scottish poet Robert Burns, contains a few words of his native tongue which perhaps boys and girls may not understand. These are maun (must), stour (dust), wa's (walls), bield (shelter), and histie stibble (dry stubble). Few of the other words vary much from ordinary English.

WEE, modest, crimson-tippèd flower,
Thou'st met me in an evil hour;
For I maun crush amang the stour
Thy slender stem;
To spare thee now is past my pow'r,
Thou bonnie gem.

Alas! it's no thy neebor sweet,
The bonnie lark, companion meet,
Bending thee 'mang the dewy weet
Wi' spreckled breast,
When upward springing, blythe, to greet
The purpling East.

Cauld blew the bitter-biting North
Upon thy early, humble birth;
Yet cheerfully thou glinted forth
Amid the storm,
Scarce rear'd above the parent earth
Thy tender form.

The flaunting flow'rs our gardens yield,
High sheltering woods and wa's maun shield;
But thou beneath the random bield
O' clod or stane
Adorns the histie stibble field,
Unseen, alane.

There, in thy scanty mantle clad,
Thy snawy bosom sunward spread,
Thou lifts thy unassuming head
In humble guise;
But now the hare uptears thy bed,
And low thou lies!

AT SEA

There is a fine sense of the swift movement of a great ship across the salt sea in this poem by Allan Cunningham, a Scottish author who lived from 1784 to 1842, spending the half of his life in London, where he wrote a great deal about art.

A WET sheet and a flowing sea,
A wind that follows fast,
And fills the white and rustling sail
And bends the gallant mast;
And bends the gallant mast, my boys,
While like the eagle free,
Away the good ship flies, and leaves
Old England on the lee.

O, for a soft and gentle wind!
I heard a fair one cry;
But give to me the snorting breeze
And white waves heaving high;
And white waves heaving high, my boys,
The good ship tight and free—
The world of waters is our home,
And merry men are we.

There's tempest in yon hornèd moon,
And lightning in yon cloud;
But hark the music, mariners!
The wind is piping loud;
The wind is piping loud, my boys,
The lightning flashes free—
While the hollow oak our palace is,
Our heritage the sea.

HIS MOTHER'S JOY

LITTLE, I ween, did Mary guess,
As on her arm her baby lay,
What tides of joy would swell and beat,
Through ages long, on Christmas day.

And what if she had known it all,—
The awful splendour of his fame?
The inmost heart of all her joy
Would methinks have been the same:

The joy that every mother knows
Who feels her babe against her breast:
The voyage long is overpast,
And now is calm and peace and rest.

"Art thou the Christ?" The wonder came
As easy as her infant's breath:
But answer none. Enough for her
That life had triumphed over death.

JOHN WHITE CHADWICK.

THE LOST DOLL

I ONCE had a sweet little doll, dears,
The prettiest doll in the world;
Her cheeks were so red and and so white, dears,
And her hair was so charmingly curled.

But I lost my poor little doll, dears,
As I played on the heath one day;
And I cried for more than a week, dears,
But I never could find where she lay.

I found my poor little doll, dears,
As I played on the heath one day;
Folks say she is terribly changed, dears,
For her paint is all washed away,

And her arms trodden off by the cows, dears,
And her hair is not the least bit curled;
Yet for old sake's sake, she is still, dears,
The prettiest doll in the world.

CHARLES KINGSLEY.

THE MEN OF OLD

Lord Houghton, who was born in 1809 and died in 1885, was famous as the friend and patron of the poets of his days, eminent as a statesman, a great traveler, and no mean author both in prose and verse. In the following poem he justly celebrates the men of the past, whose lives were simpler than ours can be in this complex age. It is true that "a man's best things are nearest him." In all ages man has been prone to seek the things remotest from him, but it may be that this is Nature's way to maintain the progress of the race, although it is not the way to individual happiness.

I KNOW not that the men of old
Were better than men now;
Of heart more kind, of hand more bold,
Of more ingenuous brow;
I heed not those who pine for force
A ghost of time to raise,
As if they thus could check the course
Of these appointed days.

Still, it is true, and over-true,
That I delight to close
This book of life self-wise and new,
And let my thoughts repose
On all that humble happiness
The world has since foregone—
The daylight of contentedness
That on those faces shone!

With rights, though not too closely scann'd,
Enjoy'd as far as known,
With will, by no reverse unmann'd,
With pulse of even tone,
They from to-day, and from to-night,
Expected nothing more
Than yesterday and yesternight
Had proffer'd them before.

To them was life a simple art
Of duties to be done;
A game where each man took his part,
A race where all must run;
A battle whose great scheme and scope
They little cared to know,
Content, as men-at-arms, to cope
Each with his fronting foe.

Man now his virtue's diadem
Puts on, and proudly wears—
Great thoughts, great feelings, came to them
Like instincts unawares;
Blending their souls' sublimest needs
With tasks of every day,
They went about their gravest deeds
As noble boys at play.

And what if Nature's fearful wound
They did not probe and bare,
For that their spirits never swoon'd
To watch the misery there—
For that their love but flow'd more fast,
Their charities more free,
Not conscious what mere drops they cast
Into the evil sea.

A man's best things are nearest him,
Lie close about his feet;
It is the distant and the dim
That we are sick to greet;
For flowers that grow our hands beneath
We struggle and aspire—
Our hearts must die, except they breathe
The air of fresh desire.

Yet, brothers, who up Reason's hill
Advance with hopeful cheer—
Oh, loiter not, those heights are chill,
As chill as they are clear;
And still restrain your haughty gaze
The loftier that ye go,
Remembering distance leaves a haze
On all that lies below.

A NATION'S STRENGTH

These lines by Ralph Waldo Emerson, the great American writer, express the pith of much philosophy; and the strange thing is that while all will admit the truth which the poet utters, they are few, indeed, who can bring themselves to shape their own conduct in accordance with it.

NOT gold, but only man can make
A people great and strong—
Men who, for truth and honour's sake,
Stand fast and suffer long.

Brave men who work while others sleep,
Who dare while others fly—
They build a nation's pillars deep,
And lift them to the sky.

THE STORMY PETREL

The sea-bird of this poem ranges the ocean, hardly ever coming to land. It is a small bird, not much bigger than a lark, and, save for a few white feathers on wings and tail, sooty black in color. Sailors call it "Mother Carey's Chicken," and, partly because it is always busiest in stormy weather, skipping from wave to wave, and partly because of its color, look upon it as a bird of ill omen. The poem is written by Barry Cornwall (Bryan Waller Procter), several of whose poems have already appeared in our book.

A THOUSAND miles from land are we,
   Tossing about on the roaring sea;
From billow to bounding billow cast,
Like fleecy snow on the stormy blast.
The sails are scattered abroad like weeds;
The strong masts shake like quivering reeds;
The mighty cables and iron chains,
The hull, which all earthly strength disdains—
They strain and they crack; and hearts like stone
Their natural hard, proud strength disown.

Up and down! Up and down!
From the base of the wave to the billow's crown,
And amidst the flashing and feathery foam
The Stormy Petrel finds a home—
A home, if such a place may be
For her who lives on the wide, wide sea,
On the craggy ice, in the frozen air,
And only seeketh her rocky lair
To warm her young, and to teach them spring
At once o'er the waves on their stormy wing.

O'er the deep! O'er the deep!
Where the whale, and the shark, and the swordfish sleep,
Outflying the blast and the driving rain,
The Petrel telleth her tale—in vain;
For the mariner curseth the warning bird
Which bringeth him news of the storm unheard!
Ah! thus does the prophet of good or ill
Meet hate from the creatures he serveth still;
Yet he ne'er falters—so, Petrel, spring
Once more o'er the waves on thy stormy wing!

SORROW

We have our troubles, be they great or small, and it oftenest happens that that which hurts the deepest we shrink from uncovering to any human eye. This little poem by Alice G. Howard tells us that there is One from whom we may always be sure of obtaining sweetest sympathy and understanding.

THE sorrow that nobody mentions,
   The sorrow no one may share,
Is the sorrow the dear Lord giveth
   His sweetest, tenderest care.

He places His hand on the wellspring,
   The quivering lips refrain,
And the eyes smile forth in defiance,
   His love enfolding the pain.

He knows where the hurt is the deepest,
   The tears of night and of day,
And, whispering softly, "I love you,"
   Brushes the teardrops away.

The sorrow that nobody mentions,
   The sorrow no one may share,
Is the sorrow the dear Lord giveth
   His sweetest, tenderest care.

GREAT NATURE IS AN ARMY GAY

Richard Watson Gilder, who was born in 1844 and became editor of "The Century Magazine" in 1881, was an accomplished American poet. When he sings of nature he sometimes strikes a serious and almost a forbidding note as in this fine example of his skill. The brisk idea of the opening lines is not maintained, and the reader soon begins to think that nature's army, so far from being "gay," is an appalling host of ants or locusts that mean to devour everything in their path, leaving not a shred behind—not even the poor author.

GREAT Nature is an army gay
   Resistless marching on its way;
I hear the bugles clear and sweet,
I hear the tread of million feet.
   Across the plain I see it pour;
It tramples down the waving grass;
Within the echoing mountain-pass
   I hear a thousand cannon roar.

It swarms within my garden gate;
   My deepest well it drinketh dry.
It doth not rest; it doth not wait;
   By night and day it sweepeth by.
Ceaseless it marches by my door;
It heeds me not, though I implore.
I know not whence it comes, nor where
It goes.   For me it doth not care
Whether I starve, or eat, or sleep,
Or live, or die, or sing, or weep.
And now the banners all are bright,
Now torn and blackened by the fight.
Sometimes its laughter shakes the sky,
Sometimes the groans of those who die.
Still through the night and through the livelong day
The infinite army marches on its remorseless way.

NOVEMBER IN ENGLAND

This poem is an excellent example of the half-serious, half-jocular spirit in which Thomas Hood could write when the mood seized him. He was, of course, capable of serious and more enduring work, as in his "Song of the Shirt" on page 2129, and "The Dream of Eugene Aram" on page 2818; but this little ode to November is perfect in its feeling of helpless despair. The description suggests London rather than England, and it was most likely out of the fulness of his own experience of a November fog in the metropolis that the afflicted poet produced this bundle of negatives.

NO sun, no moon,
   No morn, no noon,
No dawn, no dusk, no proper time of day:
   No sky, no earthly view,
   No distance looking blue,
No road, no street, no "t'other side the way;"
   No end to any "row,"
   No indications where the crescents go;
   No top to any steeple,
No recognition of familiar people,
   No courtesies for showing 'em.
   No knowing 'em!
No travelling at all, no locomotion,
No inkling of the way—no notion,
   "No go"—by land or ocean—
   No mail, no post,
   No news from any foreign coast;
No park, no ring, no afternoon gentility,
   No company, no nobility;
No warmth, no cheerfulness, no healthful ease,
   No comfortable feel in any member,
No shade, no shine, no butterflies, no bees.
   No fruits, no flowers, no leaves, no birds—
   November!

BATTLE-HYMN OF THE REPUBLIC

Mrs. Julia Ward Howe, who, in her ninety-second year, died in 1910, may be described as one of the most eminent women of America. She won fame both as a writer and a speaker, and wrote many books, but will be remembered chiefly for this celebrated poem, written in the early days of the American Civil War, to encourage the soldiers of the North in fighting for the preservation of the Union.

MINE eyes have seen the glory of the coming of the Lord:
He is trampling out the vintage where the grapes of wrath are stored;
He hath loosed the fateful lightning of His terrible swift sword:
His truth is marching on.

I have seen Him in the watch-fires of a hundred circling camps;
They have builded Him an altar in the evening dews and damps;
I can read His righteous sentence by the dim and flaring lamps:
His day is marching on.

I have read a fiery gospel writ in burnish'd rows of steel:
"As ye deal with my contemners, so with you My grace shall deal;
Let the Hero, born of woman, crush the serpent with His heel,
Since God is marching on."

He hath sounded forth the trumpet that shall never call retreat;
He is sifting out the hearts of men before His judgment-seat:
Oh, be swift, my soul, to answer Him! Be jubilant, my feet!
Our God is marching on

In the beauty of the lilies Christ was born across the sea,
With a glory in His bosom that transfigures you and me:
As He died to make men holy, let us die to make men free,
While God is marching on.

SONG OF BIRDS

Longfellow in these pleasant verses seeks to impress our minds not merely with the remembered joy of the singing of some lark or thrush, but with a sense of the immenseness of the joyous bird-song which this world of ours contains. For though around our own house, or in the woods near by, the voices of the birds may be silent for the moment, elsewhere their sóngs are rising, as they will again rise on our own ears; "the birds are singing for evermore."

DID you ne'er think what wondrous beings these?
Did you ne'er think who made them, and who taught
The dialect they speak, where melodies
Alone are the interpreters of thought?
Whose household words are songs in many keys,
Sweeter than instrument of man e'er caught;
Whose habitations in the tree-tops even
Are half-way houses on the road to heaven!

Think, every morning, when the sun peeps through
The dim, leaf-latticed windows of the grove,
How jubilant the happy birds renew
Their old melodious madrigals of love!
And, when you think of this, remember, too,
'Tis always morning somewhere, and above
The awakening continents, from shore to shore,
Somewhere the birds are singing evermore.

THE PRINCESS

(*Selected*)

THE woman's cause is man's: they rise or sink
Together, dwarfed or godlike, bond or free:
For she that out of Lethe scales with man
The shining steps of Nature, shares with man
His nights, his days, moves with him to one goal,
Stays all this fair young planet in her hands—
If she be small, slight-natured, miserable,
How shall men grow? but work no more alone!
Our place is much: as far as in us lies
We two will serve them both in aiding her—
Will clear away the parasitic forms
That seem to keep her up but drag her down—
Will leave her space to bourgeon out of all
Within her—let her make herself her own
To give or keep, to live and learn and be
All that not harms distinctive womanhood
For woman is not undevelopt man,
But diverse: could we make her as the man,
Sweet Love were slain: his dearest bond is this,
Not like to like, but like in difference.
Yet in the long years liker must they grow:
The man be more of woman, she of man;
He gain in sweetness and in moral height,
Nor lose the wrestling thews that throw the world;
She mental breadth, nor fail in childward care,
Nor lose the childlike in the larger mind;
Till at the last she set herself to man,
Like perfect music unto noble words.

ALFRED, LORD TENNYSON.

THE UGLY PRINCESS

The moral to be drawn from these verses by Charles Kingsley is that men foolishly judge by appearances, and are more apt to admire and bow before mere physical beauty than to look in one who is outwardly ugly for that inner and unfading beauty of the soul, though it often happens that a beautiful spirit has but a poor and unattractive dwelling-place.

MY parents bow, and lead me forth,
For all the crowd to see—
Ah, well! the people might not care
To cheer a dwarf like me.

They little know how I could love,
How I could plan and toil,
To swell those drudges' scanty gains,
Their mites of rye and oil.

They little know what dreams have been
My playmates, night and day;
Of equal kindness, helpful care,
A mother's perfect sway.

Now earth to earth in convent's walls,
To earth in churchyard sod:
I was not good enough for man,
And so am given to God.

LITTLE VERSES FOR VERY LITTLE PEOPLE

THE Hart he loves the high wood,
The Hare she loves the hill,
The Knight he loves his bright sword,
The Lady loves her will.

REMEMBER, remember
The fifth of November,
Gunpowder, treason, and plot;
I know no reason
Why gunpowder and treason
Should ever be forgot.

HERE we go round a ginger ring,
A ginger ring, a ginger ring;
Here we go round a ginger ring,
Around about merry my Tansy.

A bowlful of nuts we sat down to crack,
Sat down to crack, sat down to crack;
A bowlful of nuts we sat down to crack,
Around about merry my Tansy.

What will you give us to tell his name,
To tell his name, to tell his name;
What will you give us to tell his name,
Around about merry my Tansy?

The last time is the catching time,
The catching time, the catching time;
The last time is the catching time,
Around about merry my Tansy.

"OLD woman, old woman, shall we go shearing?"
"Speak a little louder, sir, I am very hard of hearing."
"Old woman, old woman, shall I love you dearly?"
"Thank you, kind sir, I hear you very clearly."

MR. EAST gave a feast;
Mr. North laid the cloth;
Mr. West did his best;
Mr. South burnt his mouth
With eating a cold potato.

POOR old Robinson Crusoe!
Poor old Rob nson Crusoe!
They made him a coat
Of an old nanny goat,
I wonder how they could do so!
With a ring a ting tang,
And a ring a ting tang,
Poor old Robinson Crusoe!

BETTY PRINGLE had a little pig,
Not very little, and not very big.
When he was alive he lived in clover,
But now he's dead, and that's all over.
So Billy Pringle he lay down and cried,
And Betty Pringle she lay down and died;
So there was an end of one, two, and three:
Billy Pringle he,
Betty Pringle she,
And the piggy-wiggy.

"MOTHER, may I go to swim?"
"Yes, my darling daughter,
Hang your c'othes on yonder tree,
But don't go near the water."

OH where and oh where is my little wee dog?
Oh where and oh where is he?
With his ears cut short and his tail cut long,
Oh where and oh where can he be?

THE POOR BABES IN THE WOOD

MY dear, do you know,
How a long time ago,
Two poor little children,
Whose names I don't know,
Were stolen away on a fine summer's day,
And left in a wood, as I've heard people say?

And when it was night,
So sad was their plight,
The sun it went down,
And the moon gave no light.
They sobbed and they sighed, and they bitterly cried,
And the poor little things, they lay down and died.

And when they were dead,
The robins so red
Brought strawberry-leaves,
And over them spread.
And all the day long
They sung them this song:
"Poor babes in the wood! Poor babes in the wood!
And don't you remember the babes in the wood?"

NURSERY RHYMES OF CHILDREN OF FRANCE

The English version of these Rhymes appears side by side with the French.

C'EST la mère Michel qui a perdu son chat.
Qui crie par la fenêtre à qui le lui rendra,
Et le compère Lustucru qui lui a répondu:
"Allez, la mère Michel, votre chat n'est pas perdu."
C'est la mère Michel qui lui a demandé:
"Mon chat n'est pas perdu! vous l'avez donc trouvé?"
Et le compère Lustucru qui lui a répondu:
"Donnez une récompense, il vous sera rendu."
Et la mère Michel lui dit: "C'est décidé,
Si vous rendez mon chat, vous aurez un baiser."
Le compère Lustucru, qui n'en a pas voulu,
Lui dit: "Pour un lapin votre chat est vendu!"

MOTHER MITCHELL one day lost her pussy, alack!
And cried out of window: "Oh, who'll bring her back?"
Then old Gaffer Lustucru smilingly said:
"Your cat isn't lost—she is merely mislaid."
Mother Mitchell cried, hopefully gazing around her:
"My pussy not lost! Oh, pray, have you found her?"
Then old Gaffer Lustucru answered her pat:
"If you give a reward, you will soon get your cat."
Said old Mother Mitchell: "'Twould not be amiss,
If you find me my pussy, to give you a kiss."
But sly Gaffer Lustucru much preferred gold,
And said: "As a rabbit your pussy is sold!"

LA boulangère a des écus
  Qui ne lui coutent guère;
Elle en a, je les ai vus.
J'ai vu la boulangère aux écus,
  J'ai vu la boulangère.

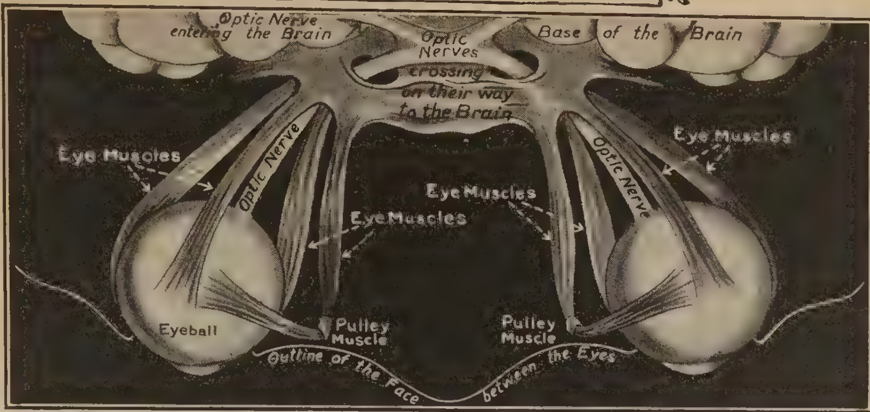
THE baker's wife has sacks of gold,
  And yet, upon my life,
She's not content, so I've been told.
I've seen the baker's wife's red gold,
  And seen the baker's wife.

FAIS dodo, Colas, mon petit frère,
  Fais dodo, t'auras du lolo.
Maman est en haut,
Qui fait du gateau;
Papa est en bas,
Qui fait du chocolat;
Fais dodo, Colas, mon petit frère,
Fais dodo, t'auras du lolo.

HUSH-A-BYE, Colin, brother of mine,
  Mustn't cry, hush-a-bye.
Mamma's up above.
Making cakes for you, love;
And Daddy, downstairs,
Nice choc'late prepares.
Hush-a-bye, Colin, brother of mine,
Mustn't cry, hush-a-bye.

AU clair de la lune,
  Mon ami Pierrot,
Prête-moi ta plume
  Pour écrire un mot.
Ma chandelle est morte,
  Je n'ai plus de feu;
Ouvre-moi la porte
  Pour l'amour de Dieu!
Au clair de la lune,
  Pierrot répondit:
Je n'ai pas de plume,
  Je suis dans mon lit.
Va chez la voisine,
  Je crois qu'elle y est,
Car, dans sa cuisine,
  On bat le briquet.

BY the moon's silver ray,
  Dear Pierrot mine,
A pen lend me, pray,
  To write thee a line.
My candle has died,
  With cold I'm aquake;
Thy door open wide,
  For dear Heaven's sake!
By the light of the moon,
  Cruel Pierrot said:
I'll not grant thy boon,
  For I am abed.
At our neighbor's, may be,
  Thou canst letters indite,
In her kitchen, I see,
  They are striking a light.



This picture helps us to understand how the eyes grow out of the brain, the optic nerve projecting till it expands into the hollow cup of the eyeball. The muscles that move the eyes are also shown.

SEEING COLORS

CONTINUED FROM 4430

IN some ways, the most wonderful of all the feats that the eye performs is the seeing of colors, and this subject of color vision, as it is usually called, is also very important from the practical point of view, because in many cases we require to distinguish one color from another; and sometimes the lives of many people may depend upon the certainty with which this is done.

We know that light is a wave motion in the ether. A better way of putting it would be that there are wave motions in the ether which, when they fall upon an eye, give rise to light. Apart from eyes to see, all Nature is in darkness. Neither the eye nor the ether alone can make light, but both are required. We can count the number of vibrations of the ether that affect the eye in a single second.

The smallest number per second that we can see is roughly about four hundred billions. When we see these we get an impression of red. The highest number we can see is roughly about eight hundred billions, and when such vibrations affect our eyes we see a sort of violet.

Now, in music, a note that is an octave higher than another has exactly twice the number of vibrations in a second; and so we may say that the amount of light that our eyes can see corresponds to one octave, the number of vibrations of the violet being about twice the number of the red. We must clearly remind ourselves once more that just as there are sounds higher and lower in pitch than the eleven octaves or so which we can hear, so there are ether vibrations higher and lower in pitch than the one octave or so that we can see.

We know that our distinguishing of colors depends upon the cones in the retina. We are bound to suppose that in those kinds of eyes where there are only rods, colors cannot be distinguished as they are seen by us; and we begin to understand the immense advantage of having a place in our eyes which is the most sensitive of all, and contains only cones.

From all this it follows that we do not see the colors of objects whose light falls upon the outermost parts of the retina, where there are no cones, or practically none. Also our eyes vary in sensitiveness at different parts of the color scale.

At the actual extremes, such as red and blue, we do not notice slight differences in color so sharply as we do in between the extremes, as in the yellow and green.

Colors vary in several ways. For instance, they vary in brightness, as we all know. The brightness of a color depends simply upon the extent to which it excites the brain. We cannot say why one color, because it is that color, should affect the brain more than another; but it is so.

Secondly, we find that colors vary in their hue, or tint, and that depends on the number of vibrations in each second of the ether waves which cause the color.

Thirdly, colors vary very much in what is called purity, or richness. The best types of eyes are very keen to appreciate this quality in colors. A pure color is one which depends upon light of one rate of vibration. The purity of a color is destroyed when it is mixed with other colors, or when it is mixed with white light, which really comes to the same thing, as white light contains all the colors.

THE MYRIADS OF COLORS THAT WE CANNOT SEE AT ALL

Now, quite apart from any question of the eyes, the question of color is simple, because it is exactly the same as the question of the pitch of sounds. Ten vibrations a second means one sound, eleven means another, twelve another, and so on; or there might be twelve and a half, and that would be a sound of still another pitch. In the same way, between light made of waves running four hundred billions to the second and light made up of waves running eight hundred billions to the second there is really an infinite number of colors—hundreds of billions of colors. That is all very well, but when it comes to our seeing them we find that the case is different.

If we take white light and pass it through a prism, we get a band of colors called the spectrum, and when we look at it we quite clearly get the impression not of a regular even change of color from one end to the other, but of comparatively few colors to which we give definite names. Of these various colors, which are commonly described as seven, some give us the impression of being mixed, and others of being pure. For instance, the color we call purple is mixed, because when we come to consider it, we see that what we call purple is really the result of our seeing a blue and a red together. What we call orange is mixed; what we are really seeing is a red and a yellow together. Then, again, Prussian blue is not a pure blue, but a mixture of blue and green.

THE THREE PURE COLORS THAT ARE NOT MADE UP OF OTHER COLORS

Now contrast with these colors such a color as crimson red. Nothing will persuade us that that is a mixture of other colors; it is simply red itself. There is also a tone of green which we cannot imagine to be made up of anything else and the same is true of ultramarine blue. Probably these are the only three colors of which this can be said. We therefore call red, green, and blue primary colors. The meaning of this is almost always misunderstood.

When we call red, green, and blue primary colors, we are not saying anything about light; we are talking about the way in which the eye sees. Light consists of waves of every rate of vibration, and any one of these rates is as good as another. But the eye, instead of being able to see each of these, has within itself means for seeing only three of them directly, and these three are red, green, and blue.

All the other colors it sees by mixing in various proportions these three kinds of sensation, and that is why we call red, green, and blue primary colors. By mixing these in various ways we can obtain the impression upon the eye of every kind of color that it can see. By mixing red and green rays in various proportions we can get the effect of all the scarlets, oranges, yellows, and yellow-greens; by mixing red and blue rays we can get all the various violets and purples; and by mixing the green and blue rays we can obtain all the various shades of blue-green.

To the three primary colors we have to add a fourth—the grey color which we get from the rods of the retina. We read about this on page 4429.

A POWER THAT NO MAN UNDERSTANDS, BY WHICH WE SEE DIFFERENT COLORS

Of course, we now want to know what are the things in the eye which correspond to these various kinds of color sensation. This can be clearly answered as regards the grey color, for we know that that is due to the rods. We know also that the

cones are responsible for the other three kinds of color sensation; but, unfortunately, we can go no farther than this, except by guessing. For instance, we do not find that there are three different sorts of cones, nor do we find, as some have supposed, that there are three different parts to each cone—one for each kind of color.

Nor can we show that there are three different kinds of nerves running from the retina to the brain, as Dr. Young supposed a century ago. It may, indeed, be that we are altogether mistaken in looking at the retina for the key to the fact that we see colors by these three sensations. It may be that the key to the facts is to be found not in the retina at all, but in the grey matter of the vision part of the brain. The fact that a man may be color-blind in one eye is rather against this.

As a rule, color-blindness occurs in both eyes, but there are cases where it is found in one eye only, and that, of course, suggests that it is the eye rather than the brain that is responsible for color vision. Color-blindness is almost always a state of things which exists from birth, and there is no cure for it.

PEOPLE WHO COULD NOT SEE THE COLOR PICTURES IN THIS BOOK

About four men out of a hundred, it is said, have one form or other of color blindness, and about one woman in a hundred. This is by no means the only case in which peculiarities are found more commonly in men than in women. Color-blindness is passed on from parents to children, and we have lately gone far to understand the laws by which it is inherited.

Very rarely we find people who are quite color-blind. The spectrum of sunlight to them appears in shades of grey throughout, being lightest in the position of yellow-green, and darkest at each end. A colored picture to them looks like a photograph or an engraving. If we believe that our three color sensations depend on the presence of three special chemical substances in the retina, then we must suppose that in such cases all these three substances are absent.

Very rare also is "blue-blindness," in which the possibility of blue sensation is absent. Then there is "green-blindness," common, and very important, in which we suppose that the substance corresponding to the green sensation is absent; in such cases bright green is confused with dark red, and a dark green letter on a black background is not seen at all. If we remember that everywhere on railways red is used as the color of danger, while green allows the driver to go on, we shall understand how very serious it would be if a railway signalman could not distinguish between a bright green color and a dark red color.

WHY RAILWAY SIGNALS ARE ALWAYS RED, GREEN, AND WHITE

Lastly, there is red-blindness, also common, which is sometimes called Daltonism, because Dalton, the man who first wrote a description of color-blindness, suffered himself from red-blindness. Here we suppose that the chemical substance affected by light and corresponding to red sensations is absent from the retina. In these cases light red is confused with dark green, and a dark red letter on a black background is not recognized at all.

Now, as nearly all color-blind men are either red-blind or green-blind, it was suggested that signal colors, instead of being red, green, and white, should be changed; for instance, blue and yellow might be employed. But this does not do. The only convenient colors to use for this purpose are red, green, and white.

It is found that a red glass allows about ten per cent. of the light behind it to come through, and a green glass rather more, but a blue glass allows only about 4 per cent of the light to come through; and yellow does not do, for there are states of the light in which yellow would not be noticed.

It is necessary, then, to test people who are to be expected to recognize lights, and if they are color-blind they must find some other employment. Even now, although there has been a great deal of discussion about it, both seamen and railwaymen are not looked after carefully enough in this respect.

THE BEST WAY OF FINDING OUT IF WE ARE COLOR-BLIND

Scores of different methods have been invented for detecting color-blindness. The best method, which is generally employed, is the use of colored worsteds, and the person who is being tested is asked to match them. If a green-blind man is handed a skein of pale green worsted, and if he draws from the heap

some worsteds which contain no green at all, then he must not be passed; or if a man takes a dark green as a match to a dark red skein, he proves himself to be red-blind, and must therefore be rejected.

HOW WE CAN REST OUR EYES BY LOOKING AT THINGS A LONG WAY OFF

Enough has already been said about spectacles and their importance in correcting the errors of refraction. Here we must note a few points which will help us to preserve our eyes, quite apart from the use of spectacles.

When the muscles inside the normal eye are at rest, the shape of the lens and other parts is such that the eye is fitted to see distant objects. There can be no doubt that the first and most natural uses of the eye are for distant and not for near vision. The course of our lives is now such that we use our eyes very much at short distances, and this means the use of the muscles inside them. That is especially true of long-sighted persons, who should, of course, not use their eyes at short distances without glasses. But, apart from that, it is a good rule for all of us to relax our eyes, when we can, by letting them rest upon something which is distant, and so giving the muscles inside them a rest, and lessening the risk of strain.

The best light for vision is daylight—not direct sunlight, but diffused daylight reflected from the sky. When we use artificial light, which we do more and more, it is a safe rule that the nearer it resembles diffused daylight, the better it will be. When we call daylight diffused, what we mean is that it comes from a large surface—the general surface of the sky. What we call a soft light is always one that is diffused in this way. Other things being equal, the larger the surface from which the light comes to our eyes, the softer it is, as Lord Rayleigh, a distinguished scientist, pointed out a good many years ago.

THE BEST WAY TO LIGHT OUR HOUSES AND TO PAPER OUR ROOMS

In modern buildings the lights themselves should be entirely hidden, and we should see by light reflected from wall or ceiling. Of course, this is expensive, because more light is required; but, though it costs more money, it saves our eyes very much.

Another great fact about diffused daylight is that it is steady, and so should artificial light be. In this respect gas is a great improvement upon candles, and electric light is the best of all.

It has lately been shown by some French students that the different qualities of light affect our eyes in different ways, quite apart from their brightness. The safe rule is that we should, as far as possible, make our artificial light of the same composition as sunlight.

In our houses, if we are wise, we shall have spaces upon which the eyes can rest. This means that we shall think twice before we use wall-papers with marked patterns; this is true especially of bedrooms, because, sooner or later, someone is likely to lie ill in a bedroom, and, whatever healthy people can stand, wall-papers with patterns are a distress and a nightmare to sick people.

THE SAFE RULE FOR READING BY DAY AND NIGHT

Great stretches of Nature are green. There is probably no color which fatigues the eye less in proportion to its brightness than the green of fresh young leaves. This is good for bedrooms and living rooms alike. Dead white is fatiguing to the eyes, and best avoided. It is excessively foolish to read with the eyes facing a source of light, especially as the light is anything but diffused. We should read with the light behind us, passing over one shoulder or the other—the left shoulder, of course, when we are writing.

So far as children are concerned, we must remember that the great majority of them are long-sighted when they are very young, and that therefore the strain of using their eyes at short distances is even greater for them than for us. The fact that the child is long-sighted ought to be hint enough to us that the best employment for its eyes at early ages is not at short distances. Few and short stretches of reading and writing are all that we ought to require of these young eyes. On the whole, the best work for a small child is its play, and its best play is open-air play with balls and hoops, and so on.

When we *do* set children to read, we must remember that we are taking certain risks with their eyes. We should take great care of the lighting arrange-

ments: we must provide glasses if the child is too long-sighted; we should be most careful to use large type deeply printed; and, in any case, the periods of reading should be brief. It is much better to employ some kind of print that makes the letters in very simple shapes.

WHAT YOUR EYES SEE WHEN YOU ARE READING THIS PAGE

When we come to think of the case of a printed page, we shall see that the letters which we distinguish are the only places where the eye does not see. What we see when we read is not the black, but the white; the letters are not really anything that we see, but gaps in our seeing. As the white occupies a great deal more space than the black, it is evident that our eyes would be much less fatigued if the state of things were reversed, and books were printed in white letters on black paper. If that were so, the eye would be rested everywhere except where there were the letters which it wishes to see.

But reading is not the only use for the eyes, and there are a great many people who think that, while we spend so much time upon reading, we are forgetting to keep our eyes open in other ways.

The time may come when the education of the eye in other matters than reading will always be included in the upbringing of any child. The time for this education, as for every kind of education, is youth, and one great difference between this kind of education of the eye and the kind that has to do with reading and writing is that it is much more suited to the young eye, which it cannot harm.

HOW GAMES OF BALL TEACH THE EYES TO WORK TOGETHER

First, then, we should educate the eye as an instrument to work with the rest of our bodies. This is the great value of games of ball for young people. They teach the two eyes how to work together, how to judge distance and rates of movement, and then, by practice, they make strong and sure connections between the parts of the brain that have to do with the eye and those which give orders to the muscles. In the whole of the after life it is exceedingly valuable to have these different brain centres well connected in this way. Second, the eye should be carefully trained by means of drawing and modeling. We are all clumsy when we are very young. The good use of the fingers is invaluable in a thousand ways. One of the great reforms in education of the near future will be the greater use of the hands and fingers.

This really means the greater training of the eye, for a good deal of clumsiness of the finger is really clumsiness of the untrained eye. Drawing and modeling strain the eyes far less than reading and writing, and a great argument in their favor is the pleasure with which children take to them. They not only train the eye as an instrument of the will, helping us to do what we want, but they also train it as an instrument of the part of our nature which thinks.

A GREAT MAN WHO WOULD STAND FOR TEN MINUTES BEFORE A FLOWER

The highest use of the eyes is that which is most neglected in all systems of education at present; it is the use of the eyes as instruments for observing with, for seeing what are the facts of earth and sea and sky, so that we may think about them—that is to say, the highest use of the eye is that which serves the highest part of our minds, but for this the eye requires great training.

A little story about one of the greatest men who ever lived will show us the difference between the eye that has been taught to see and the eye that has not been so taught.

One of his friends once asked Charles Darwin's gardener about his master's health, and how he had been progressing lately.

"Oh," he said, "my poor master has been very sadly! I often wish he had something to do. He moons about in the garden, and I have seen him stand doing nothing before a flower for ten minutes at a time. If he only had something to do, I really believe he would be better."

But Darwin was really seeing great truths about the flower which no eye had ever seen before, and which the gardener was quite incapable of seeing, however closely he might look at the same flower. It is the kind of seeing which was practised by Charles Darwin that we should also try to practise.

THE NEXT PART OF THIS IS ON PAGE 4635.

THE OLD GOBLIN TOLD STORIES OF NORWAY

The old goblin from Norway spoke pleasantly about the stately rocks and foaming waterfalls of his home. He told of the clear winter nights, the sleigh-bells, and how the boys run with torches over the smooth ice.

THE ELFIN HILL

CONTINUED FROM 4416

SOME lizards were scampering about in the hollow of an old decayed tree. "What a noise is going on in the Elfin Hill!" said one. "I have not been able to close my eyes for two nights."

"They propped up the top of the hill with four red posts till cock-crow this morning, so that it is well aired, and the elfin maidens have learned new dances," said another lizard.

"The blind earth-worm has just come from the Elfin Hill," cried a third lizard. "He says that they expect grand company. All the will-o'-the-wisps are preparing a torch-dance."

"Who can these strangers be?" asked all the lizards. "Whatever is the matter?"

Just then the Elfin Hill opened, and an old elfin maiden came out and tripped down to the seashore to the night-raven.

"You are invited to the hill to-night," said she; "but the king wishes you to take round the invitations."

"Who is to be asked?" asked the raven.

"Everyone may come to the great ball, even humans, if they can only talk in their sleep. But for the feast we can only ask persons of high rank, the merman and his daughter, all the old demons of the first class, with tails, the hobgoblins, and the little imps."

"Croak!" said the night-raven, as he flew off on his errand. The elfin maidens were already dancing, clad in shawls woven from moonshine and mist. The hall of the Elfin Hill had been washed with moonshine, and the walls glowed like tulips. In the kitchen frogs were being roasted, and salads of mushrooms and hemlock were being prepared. The king's gold crown was being polished with the best ground slate pencil, and there was a hustle and a bustle everywhere.

"Father dear," asked the elf-king's youngest daughter, "may I now hear who our noble visitors are?"

"I suppose I must tell you," he replied. "Two of my daughters must be married shortly, for the old goblin, from Norway, who is very, very rich, is coming with his two sons, both of whom are seeking wives. The old goblin is an honest old Norwegian, cheerful and straightforward, but they say that his boys are bad-mannered. You must show me that you know how to teach them manners."

Two will-o'-the-wisps then rushed in to the king's presence, breathless.

"They are coming! They are coming!" cried the foremost.

"Give me my crown," said the king, "and let me stand in the moonshine."

The daughters put on their shawls and bowed low. Before them stood the old goblin from Norway, wearing a crown of ice and polished fir-cones. Beside him were two strong, bare-throated men, his sons.

"Do you call that a hill?" said the younger, pointing to the Elfin Hill. "We should call it a hole in Norway."

"My boys," said their father, "a hole goes in and a hill stands out. Have you no eyes? Take care, or people will think that you are badly brought up."

They all entered the Elfin Hill, where the select company were assembled. The merman and other sea-folks sat in great water-tubs, and they declared that they were quite at home. All behaved perfectly except the two young men, who put their legs on the table.

"Feet off the tablecloth!" said their father. They obeyed but slowly, and then performed many other rude tricks.

But the old goblin was very different, and spoke pleasantly about the stately rocks and foaming waterfalls of his home. He told of the clear winter nights, the sleigh-bells, and how the boys run with torches over the smooth ice. He described everything so vividly that all his hearers felt that they could see everything—the saw-mills going, the men singing, and the maidens dancing.

Then the elfin girls were asked to dance, and they danced with stamping feet, and ended by flying about like the shavings in a saw-pit, so that some of the company became giddy.

"Stop!" cried the old goblin. "Is that the only housekeeping they can do? Can they do nothing more than dance and make a whirlwind?"

"You shall soon see," replied the elf-king, and he summoned his youngest daughter. She put a white chip of wood in her mouth, and vanished immediately. The goblin said that he should not like a wife of his to be able to do this.

Another daughter made a figure follow her like a shadow, which no goblin ever has. The third had learned in the brew-house of the moor witch how to make elf-puddings with glow-worms.

"A good housewife," said the old goblin, and smiled at her. Then came the fourth daughter carrying a large harp, and when she struck the first chord everyone lifted a leg, and at the second all had to do what she wished.

"She is a dangerous woman," said the old goblin; and his sons walked out, for they had had enough of it.

"And what can the next daughter do?" asked the old goblin.

"I have learned all that is Norwegian," she replied; "and I will never marry unless I go to Norway."

But her youngest sister whispered:

"That is only because she has heard in a song that when the earth decays the cliffs of Norway will remain, and she wants to get there and be safe."

"Ho, ho!" laughed the old goblin, "is that what she means? What can the seventh and last do?"

"The sixth comes before her," said the elf-king; but the sixth daughter would not advance a step.

"I can only tell the truth," she said. "No one cares for me, nor troubles about me; and I have enough to do to look after myself."

So the seventh came forward, and she was able to tell stories, as many as one wished on any subject.

"Now, here are my five fingers," said the old goblin; "tell me a story for each of them."

She took him by the wrist and told him stories so that he laughed until he almost choked.

"Hold fast on to what you have!" cried the old goblin. "This hand is yours; for I myself will marry you."

Then she said that the stories about two of the fingers had not yet been told.

"We will hear those tales in the winter," said he, "and also about the fir-trees and the beech-trees, and ghost stories, for no one in Norway can do it so well. But where are my sons?"

They were chasing the will-o'-the-wisps, blowing out their torches.

They said they had no wish to marry, and lay down on the table to sleep. But the old goblin exchanged boots with his bride, as the custom was, and danced about with her until cock-crow.

The hill then closed up, and the lizards said one to another:

"How delightful was the old goblin!"

"His sons pleased me more," said the earth-worm; but, then, that poor, simple creature was quite blind.

THE STORY OF THE MONTHS

JANUARY; FEBRUARY; MARCH; APRIL; MAY; JUNE; JULY; AUGUST; SEPTEMBER; OCTOBER; NOVEMBER; DECEMBER

ALL the gods are dead. Centuries have rolled away since men believed in them. And yet the memory of these old gods and goddesses are enshrined in many forms, and will endure to the end of time. So deep was the faith of the Romans in their gods that throughout the world the names and characters of these mythical persons are associated with some of the most sacred and some of the most practical affairs of modern life. Some of the ghosts of the dead gods even haunt the months that make up the total of the Christian calendar. Let us imagine that we are witnessing a pageant of the months.

First would come a strange figure, a god with two faces, a god who looks forward and who looks back, and who carries in his left hand a key. This is Janus. The Romans worshipped Janus in a temple that was kept open during war, but was closed in times of peace. He was the god of Beginnings and Ends. The pious Roman who wanted to begin a matter well, or to make a good end of something, implored the assistance of Janus. This god was also the doorkeeper of heaven, and the Romans regarded him as the protector of their gates and doorways. His temple had twelve doors in it, just as the year has twelve months.

It was a clever idea of the Romans to name the first month of the year after Janus, because he suggests looking forward and looking back. Everyone who thinks at all feels at the beginning of a year that it is a time for looknig back on the past, and also a time for looking forward to the future. It is a month of beginning and a month of end.

THE ROMANS NAMED THE FIRST MONTH JANUARY, AFTER THE TWO-FACED GOD JANUS

The second figure in our pageant is February, a month set apart. At one time February was the last month in the year, but 450 years before Christ it was placed after January instead of before, and became the second month. In England and her colonies, March was reckoned as the beginning of a year, and so February once again became the last month. Now it has settled down to its second place. But every four years

FEBRUARY COMES FROM A ROMAN FESTIVAL WHICH WAS CALLED FEBRUA

February has one day added to its twenty-eight, and so it remains, the most restless and unsettled month in the calendar. This extra day is added because a full year consists of 365 days and nearly six hours. At the end of four years these odd six hours have mounted up to almost a whole day of twenty-four hours; it is given to February to make up for its short allowance of twenty-eight days. But the year that marks the century, as 1900, is not a leap year unless it can be divided by 400.

The name February comes from a Roman festival of purification named Februa, in honor of the god Lupercus. The figure that passes before us in the pageant suggests cleansing and purifying. In our own time it is towards the end of February that the house-wife thinks about her spring cleaning. The Romans regarded Februa as a festival for spiritual cleansing, but they celebrated the occasion by over-eating. The third figure in our pageant clatters by in a chariot which is drawn by two horses, named Terror and Flight. It is a mighty and threatening figure, brandishing a long spear, lifting a gleaming shield to heaven, and raising its head on high, so that the lightnings play about the great helmet. This is Mars, the god of war.

To the Romans, Mars was more than a mere fighter; they regarded him as a god who could do almost anything, because he was so strong. They prayed to him for rain, and consulted him in their private affairs, offering on his altar a horse, sheep, wolf, magpie, or vulture. When soldiers went to war, they carried

MARCH, THE NOISY, BLUSTERING MONTH, NAMED AFTER MARS, THE ROMAN GOD OF WAR

APRIL, WHICH OPENS THE GATES OF SPRING, WAS CALLED "THE OPENER"

with them a cage of chickens sacred to Mars, and before battle they would offer corn to these sacred birds, eagerly watching to see if the food were greedily eaten or rejected; if the former, it meant that Mars was on their side, if the latter, that the day would go ill with them. Mars was associated in their minds with thunder and lightning, and yet the Romans believed that the woodpecker tapping the trunk of a tree was the answer of this blustering, noisy god to their prayers. March is very often a noisy, blustering month.

How different is the fourth figure in our pageant! It is not a god and not a goddess. It is the Angel of Spring. Gracious, exquisite, tender, and kind, April follows behind the dust of Mars' bloodstained chariot, sprinkling the earth with soft showers, and calling up in the ruts and gashes made by the fiery wheels flowers so slight, and pretty, and delicate that one almost weeps to see them. April is "The Opener." The Romans saw that this month opened the gates of birth and restored to life all those lovely and gentle things which had hidden in terror from the blasts of winter. "Omnia aperit!" they exclaimed in admiration; which means, "It opens all things." And so this month of beauty and new birth,

MAY IS CALLED AFTER THE GODDESS MAIA, DAUGHTER OF ATLAS, WHO UPHELD THE WORLD

JUNO, WHO RODE IN A CHARIOT DRAWN BY PEACOCKS, GAVE HER NAME TO JUNE

when the earth wakes from its winter sleep, when the buds appear on the branches, and the woods are filled with song, is called April—"The Opener."

Behind April comes the goddess Maia. Her father was named Atlas, and it was supposed that the weight of this vast round world on which we live, with all its mountains and oceans and deep mines, rested upon the shoulders of Atlas. He had seven daughters, who lived in a mountain, and Maia was the most famous of all these seven daughters because of her son, Mercury, who ran swiftly from heaven to earth on errands for the gods and goddesses. Jupiter, the father of all the gods, took Maia and her sisters and placed them near together as stars in the sky. The cluster of six stars called the Pleiades are supposed to be Maia and her sisters. The seventh star of the cluster is invisible. It represents one of the sisters who married a man named Sisyphus, and ever after, because poor Sisyphus has been condemned to roll a stone up a hill eternally, she has hidden her face with sorrow.

Two figures come next, disputing the sixth place in the pageant. One is the goddess Juno, and the other is a man Junius. Some people think the month belongs to Juno, and others to the great Roman family of Junius.

We will let the two figures fight it out. Neither of them interests us very much. Juno was the beautiful but jealous wife

JULY, AT ONE TIME CALLED QUINTILIS, WAS RENAMED IN HONOR OF JULIUS CÆSAR

AUGUST WAS NAMED AFTER AUGUSTUS THE FIRST OF THE ROMAN EMPERORS

of Jupiter, who drove about in a chariot drawn by strutting peacocks, and Junius was a proud and haughty man, without modesty, humility, or sweetness. These two contend for the brightest and grandest place in the calendar, the month of roses, and garden glory. Whichever wins in this contention, we shall call June the month of God. We feel no admiration for the goddess or for the man; our hearts are rejoiced by the splendor of summer, and we give the glory of June to the Giver of all beauty and all joy—the mighty God who is also our Father.

The seventh figure in the pageant is one of the greatest men who ever lived, a soldier and an emperor, Julius Cæsar. When the year began with March, this month was the fifth, and the Romans called it Quintilis, which means the fifth month. Julius Cæsar not only conquered nation after nation, and not only made wise laws and wrote immortal books. He also set himself to reform the calendar, which at that time was in a sad state. The weather and the months did not agree. Spring came in January and winter in September. The month Quintilis was named in his honor.

It would take far too long to tell the story of Julius Cæsar, but we must remind ourselves, before he passes on, that he it was who invaded Britain and first taught the barbarians of that island to respect law and to desire civilization.

After Julius Cæsar follows his grand-nephew Augustus. At first he was called Octavius and ruled the Roman Empire with Mark Antony and Lepidus. Finally he became sole emperor, and did much that added to the glory and power of his magnificent empire. The people,

THE NAME OF SEPTEMBER MEANS SEVEN, AND IT WAS AT ONE TIME THE SEVENTH MONTH

OCTOBER IS THE TENTH MONTH, BUT AT ONE TIME IT WAS THE EIGHTH, AS ITS NAME MEANS

anxious to flatter him, changed his name to Augustus, meaning noble. Then they called the eighth month August.

But July had thirty-one days, and August only thirty. The Romans thought that Augustus would be jealous of Cæsar's extra day, and so they took a day from February and tacked it on to the end of August. It is easy to remember that July and August have each thirty-one days by thinking of the two great Roman emperors. The eighth month was chosen for the reason that Augustus celebrated the chief events of his life during that time. It was in August that he was made consul, ended his wars, and conquered Egypt. Augustus remains for us a splendid figure in history. His reign was called the Golden Age, for not only did he bring peace to the war-tired world, but, under his patronage, literature and art flourished exceedingly.

The immortal poets, Horace and Virgil, lived at this time, libraries were built, agriculture developed, and temples and buildings rose up on every side in all the magnificence of marble. And it was in the reign of this mighty emperor that far away in Syria the Holy Child was born, whose reign has not yet ended, and whose birth has divided time. Little did the proud Roman emperor imagine, as he boasted in his palace of how he had found Rome made of brick and had left it of marble, that a Child was then living who would divide all the ages of

NOVEMBER, THE MONTH OF GUY FAWKES, WAS FORMERLY THE NINTH MONTH

the earth, and set a Cross between the reign of Augustus and the march of a new religion.

Behind the mighty Augustus in our pageant follows only a shamefaced figure VII. It is shamefaced because it knows that it has no right to be where it is.

September is the ninth month of the year, and to call it Septem, which means seven, is quite wrong. But our friend VII. raises a glance of appeal, and seems to say to us: "Do not turn me out. I at least serve one useful purpose; I remind you of the distant past when the year began with March, and when the month following August was in very truth the seventh of the year." But we cannot help smiling, for we think of people who date their letters like this—5/9/09, and wonder if they ever reflect upon the absurdity of making 9 stand for September, which simply means 7.

After VII. comes neither god, goddess, nor emperor, but another figure—VIII. Here again is the same shamefaced look and the same appeal to antiquity. Many things as false as the name October are allowed to pass in the world, on this same score of antiquity. People dislike altering things; they are too tired or too careless to touch the monuments of the past. The Romans, when they had given the name of their great emperor August to Sextilis, the sixth month, felt that no one would be worthy to have a month named after him, and so let the old simple titles stand—September for the seventh, and October for the eighth month. Even though the calendar has been changed several times since, so great a hold had these old names laid upon the world that they were allowed to pass.

Again comes a figure—IX., meaning ninth month, or, as we say, November, although it is the eleventh. English children see this figure passing along disguised under a heavy cloak and a wide-spreading hat, with a barrel of gunpowder tucked under its arm, for November, to a great many English children, is the month of Guy Fawkes.

Our Saxon ancestors called it "Blood Month," because it was at this time they slaughtered many cattle to last them through the dreary months of winter.

Last of all comes another shamefaced figure—X. How strange that December, which is Latin for ten, should be the name for our twelfth month. But, of course, we know now that at one time this was not the last, but the tenth month in the calendar. December, which seems to us to mean the end, or the last, means simply the tenth. However, we don't bother our heads about the origin of the name when December comes; we can see coming towards us another and more cheerful figure. Big, happy, genial, and generous, comes Santa Claus, or St. Nicholas, through the snow, riding over the hills, with his inexhaustible sack of toys. The gods and goddesses have departed, the Roman emperors have strutted out of sight, and the scene is filled by this jovial Dutch figure, the good and affectionate Santa Claus, who ends up the pageant with a royal cheerfulness and a divine humanity.

DECEMBER, THE MONTH OF FATHER CHRISTMAS, IS THE TWELFTH, BUT MEANS THE TENTH

THE TIMID HARE

ADAPTED FROM THE JATAKAS

A HARE lived under a young palm-tree. One day, after his noon meal, he lay down under the tree. Suddenly he thought: "If the world should be destroyed, what would become of me?" At that very moment a large nut fell with a thud on a palm leaf. The loud noise in the tree above him startled the hare and he jumped up, exclaiming:

"This solid earth is breaking up! This solid earth is breaking up!" And without stopping to look around, he fled as fast as he could run.

Another hare saw him scampering off, and said: "Why are you running so fast?"

"Pray don't ask me," he gasped.

"What is the matter?" asked the other, running after him.

Then the hare stopped a moment and, without even looking back, cried: "The earth is breaking up." At this the second hare ran after the other. Other hares saw these two running, and all joined in the chase until one hundred thousand hares were fleeing together as fast as they could scamper along.

The deer, the bear, and the buffalo saw them, and asked the cause of their flight. On being told that the earth was breaking up, they, too, took to flight. The monkey, the tiger, and the elephant saw this bewildered herd dash by, and they, too, joined the frightened host.

When the lion saw this multitude of fleeing animals, he roared:

"What is the matter? What has frightened you?"

"The earth is breaking up!" said they.

The lion said to himself: "I am sure the earth is not breaking up. Maybe some one heard a sound that made him think so. I must find out what it was. I must stop this headlong flight, or they will all perish."

So with great leaps and bounds, he dashed ahead of them and reached the foot of the mountain first. He roared three times. They were terribly frightened when they saw the lion, and, stopping suddenly in their flight, stood all huddled together. The lion walked calmly among them and asked why they were running away.

"The earth is breaking up!" they answered.

"Who saw it breaking up?" asked he.

"The elephants know all about it," was the reply.

He asked the elephants.

"We don't know," said they; "the tigers know."

"We don't know," said the tigers; "the monkeys know."

And so on until the hares were questioned.

"This one told us," said they, pointing to a particular hare.

"Is it true, sir," said the lion, "that the earth is breaking up?"

"Yes sir, I saw it," was the answer.

"Where?" exclaimed the lion.

"In a grove of palms mixed with nut-trees," said the hare.

"As I was lying under a palm sapling, at the foot of a nut-tree, I thought, where shall I go if the earth should break up? At that very moment I heard the earth breaking up, and I fled."

"Jump on my back," said the lion to the hare, "and we will return to the place of dreadful sound." Then he sprang forward and soon reached the palm grove.

"Now, friend hare," said he, "show me the place you meant."

"I dare not, my lord," was the answer.

"Come, don't be afraid," said the lion.

"Yonder, sir, at the foot of the nut-tree," called the hare, standing afar off.

The lion went to the foot of the nut-tree and there, in the exact spot where the hare had been lying, he found a ripe nut.

"The earth is not breaking up here," he exclaimed, "but that nut must have fallen with a thud on the palm leaf and scared the hare. Now I see the cause of all this disturbance."

With the hare on his back, he hastened back to the animals and told the whole story.

"Go back to your homes," said he; "the next time you hear of danger, be sure to find out exactly what it is before fleeing from it."

THE NEXT STORIES ARE ON PAGE 4677.

These pictures show an ancient Egyptian potter carrying out the different processes of his trade.

HOW CHINA CUPS AND SAUCERS ARE MADE

CONTINUED FROM 4461

AMONG the most useful of the familiar things of our daily lives are the crockery cooking utensils which we use so freely in our kitchens, and the prettily decorated dishes which make our dining tables so fresh-looking and attractive. Just because they are so commonly used, and because they are so easy to get, we seldom stop to think how they are made, or whose inventive mind first thought of fashioning an earthen vessel. And yet, the manufacture of the pretty cup and saucer, or the simple blue and white jars which help to make the kitchen bright and homelike, and the materials of which they are made, have a long romantic history behind them.

Part of the material has come from the foundations of the earth itself. Millions of years ago mountains of granite or similar stone were formed. In the ages that have long passed away the material of which these mountains were made was separated into its parts, and made into powder by hot gases, or by the weather, and this powder was carried down and settled on low-lying lands, to form the fine white clay, called kaolin, without which none of our beautiful fine porcelain can be made. It is not, however, necessary to use this clay in the making of all earthenware or pottery. Some very good pottery is made from fine, colored clays, and a great deal of coarse earthenware is made from clays which, although they will not make fine pottery, are still plastic, that is, the clay can be molded or modeled.

The making of pottery is the oldest of the arts known to man. It is so ancient that no one knows what people first learned to make vessels of clay. In our great museums we may find well shaped bowls and vases which were buried in the tombs of the Egyptians perhaps six thousand years ago, and which have helped us to learn something of the state of civilization in Egypt, two thousand years before the time of Moses. The ancient Cretans and the Greeks made wonderfully beautiful jars and vases thousands of years ago. The Assyrians and the Persians were noted for skill in this work, and Roman pottery has been found everywhere within the limits of that great empire. The Egyptians knew how to make a beautiful glaze for their pottery thousands of years ago. It is thought that they were the first people to learn this art, and that it was taught by them to the Babylonians and Assyrians. It is believed that the Greeks knew nothing about glazing, for though their vases have a fine gloss, they are not glazed.

Copyright, 1918, by M. Perry Mills.

THE MAKERS OF POTTERY IN THE MIDDLE AGES

As we have learned in other places in this book, the civilization of Greece and Rome was almost swamped for a time by the rush of barbarian peoples from the north. These peoples knew little about the making of pottery, and the potter's work that was done in Europe in medieval times was very crude. The knowledge which had been gained during hundreds of centuries by the Egyptians, the Greeks, the Assyrians and Persians had not been lost, however, for it lingered on among the Egyptians and Syrians. After the Moslem conquests the art was revived, and beautiful pottery was made by some of the Moslem peoples.

When the Moors overran Spain, they brought with them skilled workers in various crafts, among whom were potters. Knowledge of the art of these Moorish potters soon spread through Europe. Potters of other nations were quick to learn it, and improve upon it, and soon potteries sprang up in other countries. Many beautiful things were made, especially in Italy, but they were made from heavy clay, and the "paste," under the beautiful decorations and fine glaze, was thick and coarse.

THE CHINESE WERE THE FIRST MAKERS OF FINE CHINA

Long before this time the Chinese, working by themselves, had learned to make very beautiful pottery. In their search for fine clay, they discovered deposits of kaolin. From this they made fine porcelain, as early, probably, as the time during which the Norman kings reigned in England, and when Chaucer was riding to Canterbury with the pilgrims, Chinese potters were making the exquisite wares for which kings' ransoms are paid with cheerfulness to-day. The Chinese taught the art to the Japanese, and no other people have yet been able to outdistance these nations in the making of fine porcelains.

CHINESE PORCELAIN WAS BROUGHT TO EUROPE AND IMITATED

It is said that Chinese porcelain soon found its way to Western Asia and Northern Africa and that it was brought to Europe from Cairo as early as the twelfth century. Eager efforts were made to imitate it, but for a long time they were not successful. The trouble was that the European potters did not know what clay it was that gave the Chinese porcelain its beautiful whiteness and clearness. It was not until the year 1710 that it was discovered by a chemist named Böttger, who found it, it is said, in the clay used to whiten his wig. Böttger lived at Dresden but afterward moved to Meissen, where the famous Dresden china is still made. He tried to keep his discovery secret, but in vain. In a few years porcelain was made in other countries of Europe and French and Austrian porcelain also became famous. It received its common name of china because it was first made in that country.

Before the end of the eighteenth century, a new kind of porcelain was made in England. One experimenter found that powdered flints made an excellent addition to the kaolin and other materials used. Another got the idea of adding to the mixture a white powder made from burned or calcined bones. It was found that in this way a beautiful soft paste could be produced, and this English or "bone china," as it is frequently called, proved so satisfactory, and could be made so cheaply, that its use soon spread. It is now made in large quantities in Europe and is also made in America.

BEAUTIFUL PORCELAIN IS MADE IN THE UNITED STATES

For a long time the china made in the United States was all of a heavy kind, but since the end of the last century, great advances have been made. A great deal of pretty porcelain and good earthenware is now made in the states in which suitable clay is found. Several potteries are famous for the beauty of their vases, jars and lamps, and some of the fine American bone china for table use is equal in beauty and excellence to the finest porcelain made in the Old World. American potteries are chiefly noted, however, for large articles for household use. The glistening white ware that makes our bath rooms a delight, wash tubs and other things that make life easier for the housekeeper, are made in many places throughout the country.

In the middle of the last century, Henry Doulton, a famous English potter, devised a way to make the earthenware drain pipes which are of so much use in carrying off poisonous matter and making our towns and cities healthful and comfortable. The new invention proved to be

a boon to the world, and great potteries are now engaged in making immense numbers of these pipes. Until they came into use, the best drains were built of brick, which allowed the sewage to leak through and spread its poison in all directions.

HOW THE CLAY IS MADE READY FOR USE

Many things happen to the clay after it has been taken out of the ground, before it is ready to make a dainty cup and saucer or a graceful vase or any of the numberless things for which earthenware is used. To take out any sand that may be in the clay, after it is quarried, it is mixed with water and strained through a fine sieve into a tank where it is allowed to settle, and the water is drawn off. The clay is then put into filters, the water is pressed out and the clay is ready to be shipped to the pottery. It is not yet ready for the potter, however, and the processes through which it has to go depend upon the use to which it is to be put.

To make fine bone porcelain, the kaolin is mixed with feldspar and with powder made from powdered flints and burned knuckle-bones of sheep. Water is added to the mixture and it is ground and beaten and turned over and over by machinery, for days, until it is a smooth creamy paste or "slip," and so plastic that it can be molded into any shape. When it has reached this state it may be used at once, or it may be filtered and pressed again, and folded away in a dark place for later use. Some potters put it through still another mill to press out any air that may be in it. In hard porcelain, such as the Chinese make, no bone is added, and in this case larger proportions of some of the other materials are used.

HOW PORCELAIN IS MADE FROM THE CLAY

Valuable vases, and many other things, are still made on the potter's or throwing wheel. This is a contrivance which was probably used in Egypt 6,000 years ago and has been very little altered in principle since. The potters of Babylon and Nineveh used wheels very much like it, even before the Bible was written. The throwing-wheel is a disc which revolves horizontally in a pan. The pace at which it moves is fixed by a brake which the potter controls. The wheel is still sometimes worked by the potter's foot, but most of the wheels used in large potteries are worked by machinery, and some of them by electricity.

As the throwing-wheel spins round on its axle, the potter throws the clay, which sticks to the wheel and goes round with it. Then the art of the potter comes into play. As the wheel spins he presses and pulls and molds it with his skilful hands or with tools made for the purpose. He works from the base upward, shaping the walls, making them the right height and thickness, and gradually the clay takes on the desired shape. When it is finished, the vessel is set aside to dry, so that it can be fixed on a lathe, and turned and smoothed.

Some plates, as we see in the picture, are made on a wheel. Others are made in a mold which the potter fixes to his throwing-wheel. This mold, filled with clay, is spun round on the wheel, an arm presses down upon it, squeezes the clay to the shape of the mold, and then pares it down to the proper thickness. Heavy cups are also made in such a mold, or, in some places, are thrown on the wheel. Thin, translucent cups and bowls, however, are cast in porous plaster molds, into which liquid slip is poured until they are full to the brim. The water in the slip filters through the mold, leaving a thin lining of clay. After this has reached the desired thickness all the liquid slip that remains is poured off; The mold is then placed on a kind of wheel so that the inside may be worked into its proper shape. When this is done it is put into a warm place to dry, and out of the mold comes the cup, or perhaps a cream pitcher or teapot, ready for handles or spouts, which have been made in separate molds.

THE BURNING OF THE CLAY VESSELS INTO PORCELAIN

After the clay has been shaped, the vessels are put in a drying room, and then comes the difficult part of porcelain making, the firing or burning of the clay to make it into porcelain.

For this purpose, the china is packed into closed earthenware vessels called seggars, in such a way that they will not touch each other. The seggars are packed into the kiln and when it is full the openings are closed up with fire bricks. Then fires are lighted and the heat is carried up all round the seggars, at first slowly, and then more rapidly, until the inside of the kilns has reached

an almost unimaginable temperature. The kiln is kept at this temperature for about ten hours. It is then allowed to cool so gradually that it is three or four days from the time they were put in, before the seggars are opened and the "biscuit," as the china is now called, is taken out.

HOW THE TRANSPARENT GLAZE IS MADE

Meantime in another part of the pottery a glaze has been made by mixing together materials which will make glass, and baking or firing them in the kiln until they become a solid piece of glass. This is ground up to a fine powder under heavy stones, and mixed with water to what is called the glaze "slip." Into this our cups and saucers are dipped so skilfully that every part is evenly covered with the glaze. They are then placed again in the seggars, and put back into the kiln. The furnace fires are relighted, and the temperature is again raised to a high point, and kept there for many hours, until all the materials in the glaze are well fused, and the porcelain is covered with a delicate, shining coat.

The china is now ready for the decorator, who paints on it flowers, or figures, or designs, if it is very good china. If it is of poorer quality, it is not painted; the designs are pressed on it from transfer paper. After it has been decorated, the china is again baked, or fired, to set the colors. Often the china is decorated before it is glazed, and we then speak of the decorations as being "under glaze." Many people buy plain white porcelain and paint and fire it themselves.

Some kinds of common earthenware are not dipped in glaze but receive what is called salt glaze. As soon as the heat of the kiln in which this pottery is being fired has cooled down to a certain point, the seegars are opened and a quantity of common salt is thrown in. The salt, which, as we have learned in another place, is sodium chloride, is turned into vapor by the heat. When in this state it divides into its separate parts, and as the oven cools the sodium settles down on the articles in the seggar in the form of a transparent glaze. Salt glazing is generally used in this country on heavy gray-blue ware, which we often see in cooking utensils and mugs.

Before they are put into the kiln in which they are burned, our cups and saucers and other things made of china are packed in the earthenware vessels called seggars, which we see here. The machines in the corner press the clay from which the seggars are made into the shape that the potter desires.

Pictures on pages 4542, 4546, 4547, 4548 courtesy of Lenox, Inc.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4590.

HOW THE DINNER-PLATES ARE MADE

In making plates, a mass of clay is thrown on to the potter's wheel. It is then flattened to an even thickness all over, and molded to a pattern by a gauge which ensures absolute accuracy of size and shape. Here we see a rough lump of clay on the potter's wheel, while just in front of the potter is a plate that is being shaped.

Here we see a plate being trimmed and gauged, to ensure that it is the same size as the others. As soon as a plate is shaped, it is taken by the boy on the left to the kiln. If we look at most plates, we shall observe three little marks on the bottom. These are caused by a little article, called a cockspur, which prevents the plates from touching when they are piled one above another in the seggars during the baking process.

THE BIRTH OF A BEAUTIFUL VASE

All pottery that is round in shape is made on the potter's wheel, and it is a wonderful sight to see the formless clay grow into a beautiful vase under the potter's skilful handling. As the wheel spins round and round, we see the clay gradually assuming shape. With a deft touch here and slight pressure there, the potter gives character to the clay until the wheel stops, and there is the vase ready to be baked and glazed.

Here we see the vase after the potter has been working upon it for a time. He has begun to give shape to the clay. The potter's art is one of the oldest in existence, dating back into prehistoric ages. The earliest pottery was shaped without the aid of the potter's wheel, and was made of coarse clay. Simple means of decoration were employed, the potter often making a band of circles by impressing the clay with a hollow stick.

THE CLAY GROWING INTO A VASE

In this picture we see the clay growing into a vase. The hand and eye of the potter, working in harmony, produce beautiful lines and graceful curves. Sometimes the potter and the artist between them turn an ugly lump of clay, worth a few cents, into a lovely vase, for which rich men will give hundreds of dollars.

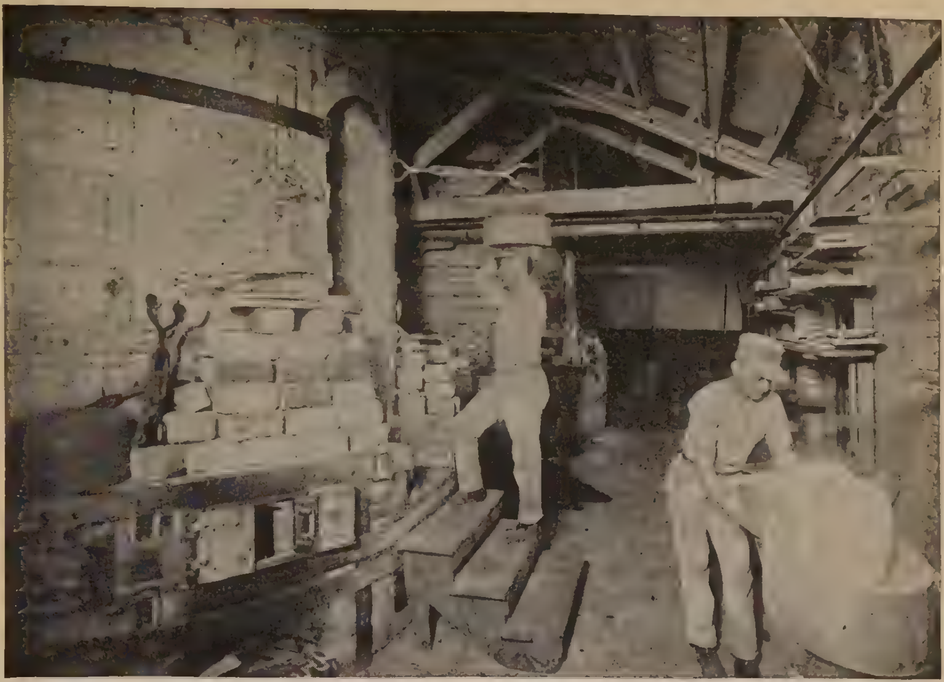
By lengthening the neck and giving grace to the body, the potter has made the vase a work of art. When this particular vase has been baked and glazed and painted, it will be worth a very large sum, and may grace a noble mansion or royal palace. A king of Prussia once exchanged some vases for a regiment of soldiers.

MIXING CLAY AND MOLDING PORCELAIN

The materials from which porcelain is made are carefully weighed, mixed with water and ground in flint-lined steel mills. In each mill about a ton of large flint pebbles grind against the square flint blocks of the lining, and as the mill revolves, the china mixture is ground and beaten between pebbles and lining. The grinding is kept up for several days and the mixture comes out a smooth, creamy slip or paste.

This shows how porcelain is made in porous molds by filling them with liquid slip and allowing them to stand until a deposit forms inside. When the deposit has become sufficiently thick to make a vase or teacup, the rest of the slip is poured off, the inside is smoothed down, and the mold dried. It is then opened and the vase or teacup is ready for handles or handle, which have been made in separate molds.

HOW PORCELAIN IS BURNED



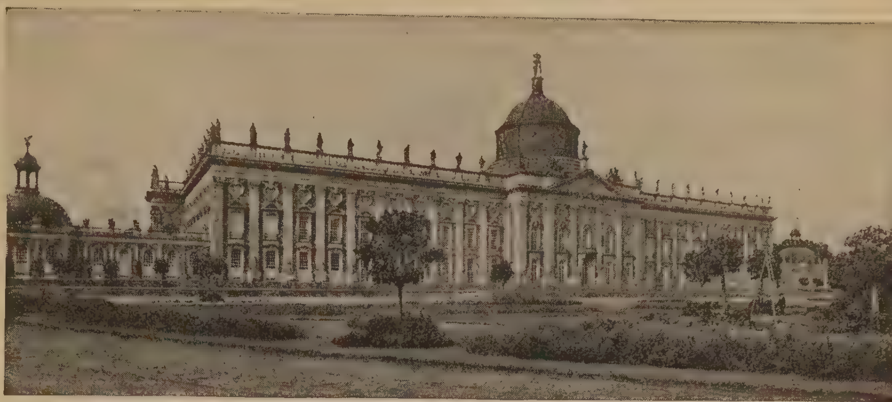
Here we see men putting china in seggars into a kiln to be burned. When the kiln is full the opening is filled with the bricks, which you see at the side, and clamped with iron bands. The firing process takes a period of from twenty to thirty hours, while twenty hours are required to cool off the kiln before the bricks are removed and the outer air is allowed to rush in. Great care and skill are required in the firing.

After the kiln has cooled, the china, now known as biscuit, is drawn out and cleaned to prepare it for the glaze, which has been prepared from materials which will make glass. Each object is evenly covered by skilfully dipping it in the glaze. The china is arranged in the kiln so that the things will not touch each other; the fires are relighted and the temperature is brought up to a point that will fuse the glaze.

THE DECORATION OF PORCELAIN

When the glaze has been fired, the porcelain is ready for the decorators. Cheap, heavy cups that have been made in a mold are decorated with transfers, but fine porcelain is painted with flowers or designs, or tinted all over. Often the china is decorated before it is glazed, and we then speak of the decorations as being "under glaze." By looking at your china you can easily tell how its decoration has been done.

After the porcelain has been decorated, it must be fired again in a small kiln like this to fix the colors. Nothing like the same degree of heat is needed, however, and so the kiln is not so strongly built. Just as much care must be used in this firing as in the others, for the minerals used for the colors—cobalt, iron, copper, manganese, gold and so on—are of course strongly affected by the degree of heat used.



THE NEW PALACE AT POTSDAM, BUILT BY FREDERICK THE GREAT

THE STORY OF FREDERICK THE GREAT

CONTINUED FROM 4448

It has been said that the history of Prussia is the history of the Hohenzollerns, its ruling family. This is largely true, and of no one is it more true than of Frederick II, whom we know as Frederick the Great. Before his time, the possessions of his house were scattered, and the country poor. He added to its wealth by seizing from Austria the rich province of Silesia, and began to link together his scattered territories by taking possession of the part of Poland which divided Brandenburg from Prussia.

Frederick, whose father was Frederick William, the eldest son of Frederick the first king of Prussia, was born on January 24, 1712. The coming of the little boy was a joyous event in the lives of his father and mother. They had already lost two little sons by death, and had only one child left, a girl named Wilhelmina, who was now five years old. When Frederick was born, his grandfather was still alive, but he died the following year. Frederick William, the boy's father, became king, and Frederick himself henceforth was known as Crown Prince.

Frederick William, who was a gruff soldier, brought his ideas of discipline into his own household, and his children were brought up very simply. For instance, Frederick tells us that his nursery fare included beer soup and bread, which, to our minds, made strange food for a little child. While he was still very small, Frederick was put in charge of Madame de Courelles, a gentle, gracious French woman, who taught him carefully, and gave him a love of the French language, and French people and manners, which lasted all his life. He was a bright, affectionate child, who loved his gentle teacher, and played and romped about the nurseries with his sister Wilhelmina. A picture, which was painted when he was three years old, shows him to us as a quaint little figure, in a velvet frock, beating a drum with one hand, while Wilhelmina holds the other. His delight in this drum gave his father the greatest pleasure. He thought it showed that the boy wanted to be a soldier and that was the dearest wish of the king's heart.

HOW FREDERICK'S EDUCATION WAS CARRIED ON

The happy days of Frederick's childhood lasted only until he was seven years old. Then the king thought it was high time that his education as a soldier and a king should begin, and put him in charge of three

Copyright, 1918, 1919, by The Grolier Society.

tutors. From that time on to the end of his life, Frederick's days were filled with work. His father, who did not believe in idleness, laid down very precise rules for every moment of his son's time. His tutors, two soldiers and a Frenchman, were given no freedom about his studies, for the king had very strong opinions about the subjects that a prince ought to study, and the time that should be given to each.

Latin the king thought was unnecessary. Therefore, the prince was not to learn it. German and French, said the king, were sufficient for his needs, and he was taught no other language. He was to learn arithmetic, mathematics, and economy. He was to pay special attention to the history of his family, and of the hundred and fifty years before his time; but he was only taught a general knowledge of ancient history. Later on he was to learn the science of fortification, and the formation of camps. Above all, said the king, his son's tutors were to impress on his mind the belief that nothing could bring a prince true honor and glory but war, and that if he did not love it, he would be despised by all men. This teaching, as we shall see, bore fruit later on.

At this time, the king made up a company of about a hundred boys of about Frederick's own age. He was drilled with these boys, just as if they were all grown men and soldiers, and a year or two afterward he was put in command of the company. When he was about nine years old, an arsenal of tiny guns was set up in one of the halls of the palace, and there, with a few of his friends, he was taught to mount guns, and fire the batteries just as if he were in actual warfare. This sounds as if it might be very good fun, but it was not fun to Frederick. It was hard work, and the discipline in his little company was just as strict as the discipline in the army. He had to get up at seven o'clock on Sunday, and six o'clock on week days. He was taught to wash and dress himself and to teach him to be quick in his movements, he was given only fifteen minutes to dress, to say his prayers, and to eat his simple breakfast. Not many boys can move so quickly as all this, and perhaps his father had some excuse when he began to find fault with him, and call him a dirty boy.

FREDERICK'S UNHAPPY BOYHOOD AND YOUTH

Unhappily, Frederick William had very little patience with his son, and found fault with him for many reasons. The king had a very quick temper, and Frederick was afraid of his father and shrank from the violence with which he was treated whenever he did anything of which his father did not approve. On the other hand the father resented the boy's fear of him. He wanted his love and confidence, and resented the affection that was shown by the boy to his mother and sister and his tutors.

As Frederick grew older, the differences between him and his father increased. Frederick disliked hunting, which was one of his father's chief pleasures, and said that riding over freshly seeded ground was great waste. He wearied of the perpetual drilling that he had to undergo. He loved music and literature and had visions of being a poet. He was a handsome youth, and as he grew up, he developed a love of fine clothes, and rebelled against having nothing but his uniform to wear. On the other hand, his father thought that hunting was a manly sport, that time spent on music and literature was wasted, that it was an honor to wear the uniform of his army, and that love of fine clothing was womanish. The truth is that Frederick would have made a very bad poet, and never learned to write well in either French or German. He was a born leader of men, and was of the stuff of which, in our day, great captains of industry are made. At the same time, his love of music and literature was a great boon to him all his life, and if his father had understood that the prince was quite as safe in indulging his love for music as he himself was in making a hobby of creating regiments of very tall, rather useless soldiers, who never fought, all might have been well.

But this Frederick William could not see. He loved his country, and had worked hard to make it prosperous and powerful. He feared that his son would grow up to be self-indulgent and useless, and would undo the work of his life. "Fritz," he said, "is a poet, and will spoil all my labor." The queen and the Princess Wilhelmina took the prince's part; the king grew more and more angry. Prince Frederick looked upon his father

as a mean, selfish tyrant, and life at the palace was very unhappy.

Unknown to his father, Frederick learned to play the flute, and one of his tutors taught him Latin. But the king found this out. He ordered his son's books to be sold, had the flute put out of the way, and with his own hands burned a handsome coat which the prince had bought.

As the prince grew to manhood, the quarrels between him and his father became more frequent. We have a very pitiful letter written by Frederick when he was about sixteen, in which he said that he had not ventured to see his father for a long time, chiefly because he "anticipated a worse reception than usual," and begged his father "to give over the fearful hate which had appeared so plainly in his whole countenance and to which," the poor boy said, "I cannot accustom myself." Much of the trouble, however, was Frederick's own fault. He made some bad companions, got into debt, and fell into wild ways, which the king, who was a really good man, thought were beneath the dignity of a man, and much more of a king. Frederick William always carried a cane, and in his anger and distress did not scruple at all to use it on his son's shoulders. At times he would scarcely speak to the prince. Often he would not help him at dinner, so that the boy had to leave the table hungry. It is said that more than once, the king flung plates at the prince's head, and that he even tried to hang him with a heavy window cord. Sometimes he covered him with abuse in the presence of others, and when the prince remained silent under his harsh taunts, accused him of cowardice.

Copyright, Underwood & Underwood, New York.

On this hill stood the castle where the Hohenzollerns lived in the days before they became burgraves of Nuremberg. The castle was allowed to fall into ruin, but in the nineteenth century was rebuilt by Frederick William IV of Prussia. Nothing of the old castle except the chapel remains, but the new building was designed to look as much as possible like the fortress of the old counts. The territory which surrounds it belonged to the kings of Prussia, and the castle was sometimes used by the royal family as a summer residence.

THE PRINCE ATTEMPTED TO RUN AWAY AND WAS IMPRISONED

At length Frederick felt that he could stay in his home no longer and made an attempt to run away. He was unsuccessful. The king had him arrested and imprisoned in the castle of Cüstrin, and tried by court martial as a deserter from the army. The court was compelled to sentence Frederick to death, and, in spite of the sorrowful prayers of the queen and

all his other children, and the indignation of the army and the country, the king threatened to have the sentence carried out. The emperor, however, pleaded for the boy, and this gave the king an excuse to change the punishment. Nevertheless, the friend who had helped the prince in his preparations to escape, was by the king's direction sentenced to death, and was executed before the prince's window. "Pardon me, dear Katte," the prince said as his friend was led past. "Oh, that this should be what I have done for you!" And Katte answered, "Death is sweet for a prince I love so well!"

Frederick, who from the time of his arrest had been very severely treated, did not know for months whether he was to live or die. He was dismissed from the army and his uniform was taken from him, but after he had taken an oath of obedience, and written a penitent letter to his father, he was released from his prison. He was not allowed, however, to leave the town of Cüstrin except with the permission of the commandant, and then only for a day, and was made to learn the business of governing the province in which he was confined. Then he set himself as he had never done before to gain his father's favor. He worked and studied hard, and made good use of his time, and the reports of his conduct were so good that at the end of a year the king let him go back to Berlin. He was taken back into the army and after a time was given command of a regiment and made governor of the province of Rüppin. The next year, to please his father, he married a cousin of the empress of Austria, the Princess Elizabeth of Brunswick-Bevern. Unfortunately he never really loved his wife, and though they agreed very well while they were young and gay, they seldom met in their later years.

The shock of Frederick's imprisonment and the death of his friend had been so great that he had become quite changed. He never afterward gave any one his confidence, and from being an affectionate boy, he turned into a cold, hard, selfish and ambitious man. Even his sister Wilhelmina, whom he really loved, complained of his changed manner, and while he was always loving and kind to his mother, she had no really important influence in his life.

Still, the years between his marriage and his father's death were the happiest in his life. He had a beautiful house, at some distance from Berlin, and though he had plenty of work to do, he had freedom to indulge his own tastes. The king's health grew poor, and as he saw that his son would make him a worthy successor, he learned to depend on him. During these years, the king sent an army to the help of the emperor, when the king of France invaded Germany. Frederick went with this army, and although he was not in command, his father was much pleased with his conduct in this war.

ON HIS FATHER'S DEATH, FREDERICK BEGAN TO REIGN

Frederick William died on May 21, 1740, and the prince succeeded him as Frederick II, king of Prussia, margrave and elector of Brandenburg, and duke of Cleves in Westphalia. Many people had thought that when Frederick ascended the throne he would make the court a scene of splendor, but in this they were disappointed. He contented himself with the simplest ceremonies on his accession to the throne, and spent the first months of his reign in getting the business of administration well in hand. He made no effort to change his father's way of government, and if anything, he made himself more absolute than his father had ever been. He never had a cabinet. He appointed three ministers, but they had no influence over the affairs of state, and simply carried out the instructions that he gave them.

We usually think of Louis XIV as the best modern example of an absolute king, but as a matter of fact, Frederick II of Prussia, who took counsel with no one, was more absolute than any king of France that ever lived. Nevertheless, he was perhaps as good a king as an absolute ruler could be, and gave a great deal of thought to the welfare of his people. As soon as he began to reign, he took measures to relieve the poor of the kingdom. He abolished torture, which up to that time had been used in criminal trials, allowed freedom of the press, and decreed that all the people should be free to worship God in their own way.

His father had left him a magnificent army, in which there were some regiments of immensely tall men. Frederick at once disbanded these regiments, and the world took this as a sign that he

would reduce his army, and hoped that he would treat it as a highly polished weapon, to be kept for ornament, not use. Men said that he would settle down to the ordinary work of government, and the pleasure of his literary pursuits, but Frederick had other ideas. He thirsted for glory, which he had been taught to look for in war. Very quietly, he raised the army to 100,000 men, drilled and trained it as no army had ever been drilled and trained before, and waited for an opportunity to use it.

THE INVASION AND CONQUEST OF SILESIA

The opportunity that he looked for came, a few months after he began to reign, on the death of the Emperor Charles VI. Charles had no son, but, as we have read in the story of Austria-Hungary, his daughter, Maria Theresa, succeeded to his dominions. Now in these dominions was included the little country of Silesia, which slopes gently from the plains of Brandenburg to the crest of the Bohemian Mountains. Frederick wanted to add this rich province to his own possessions, and when he heard of the emperor's death, without losing an instant of time, he laid his plans to invade it. Within a few weeks he had his army ready on the border, and then, setting up an old claim to four small duchies in the south, he marched very quickly into the country.

There were only a few thousand Austrian soldiers in Silesia, too few to stop Frederick's army, and in a few weeks the whole country, except a few fortified towns, was in his hands. The next year, the Austrians gathered an army together, and made Frederick fight to keep his conquest, but they were not able to drive him out.

When peace was made, he kept all of Silesia, except a small strip of mountain-

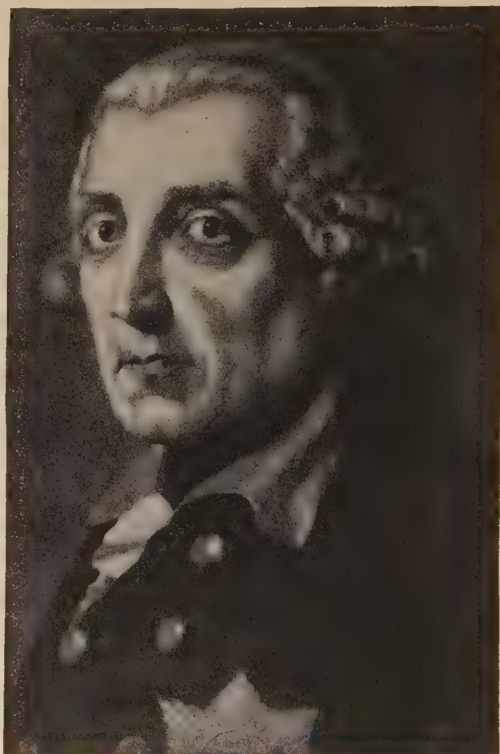
Copyright, Underwood & Underwood, New York.

This is part of the front of Sans Souci Palace at Potsdam, which was built by Frederick the Great, who also had a considerable part of the fine gardens, which surround the palace, laid out. Frederick called the palace Sans Souci, which means "without care." He lived there much of his time during the last years of his life. A number of his personal belongings are carefully preserved at Sans Souci. Near by is the large New Palace, which Frederick also built and which was generally used as a residence by the German emperors.

ous country, which Austria was able to hold, and he also got the little county of Glatz, which lies between Silesia and Bohemia.

While the war for the possession of Silesia was going on, the elector of Bavaria, who claimed the thrones of Austria, Hungary and Bohemia, began another war against Maria Theresa to take her dominions from her. This war, known as the War of the Austrian Succession, was of great assistance to Frederick and he used his influence to have the elector of Bavaria chosen emperor with the title of Charles VII.

As soon as the treaty was signed which gave him Silesia, he set to work to make the country into a Prussian province, and in this he was greatly helped by the fact that the people had been more or less oppressed by their Austrian rulers. Frederick had been careful to impose as little hardship as possible upon them during the war. They looked upon him as a champion, and the greater number of the population were glad to change their allegiance. His rule was stern, but it brought prosperity, and the people rejoiced in their new found peace.



After he began his wars, Frederick always wore his uniform, a blue coat with red collar and facings. After the fashion of his time, he wore a short, curled wig, tied back with ribbon. He always wore a cocked hat of felt.

WHY FREDERICK BEGAN THE SECOND SILESIAN WAR

Meantime the War of the Austrian Succession went on and for two years the armies of Maria Theresa were successful. But Frederick feared that if she were victorious, she would try to wrest Silesia from him. Therefore he went to the aid of the emperor, invaded Maria Theresa's kingdom of Bohemia with a large army, and the Second Silesian War began.

This war, like the first, lasted for two years. The king of Saxony joined Maria Theresa, and sometimes it seemed as though Frederick would lose the war. On the whole, however, he was successful. He found out the most secret plans of his enemies, and defeated them, and at the end of the second year, peace was made. The treaty was signed on Christmas Day, and when, a week later, Frederick went home to Berlin, the people greeted him with cries of "Frederick the Great." He was saddened, however, by the news that one of his old tutors was dying, and it showed well for him that he found time to go at once to see this true old friend.

After the Second Silesian War was over, Frederick had ten years of peace. Thanks to his father's training, he was a good man of business and during this time he built up the prosperity of his dominions. He encouraged agriculture, manufactures and commerce. Swamps were drained, and moorlands brought into cultivation. It is strange, however, that with all his love for learning, and his interest in the prosperity of the country, Frederick took no pains to see that the great mass of the people were educated.

WHY THE SEVEN YEARS WAR WAS FOUGHT

Meantime the Emperor Charles VII died. Maria Theresa's husband was made emperor in his place, and she made peace with Bavaria and France. But, although she had ceded Silesia to Frederick, she never stopped making plans to get it back, and before many years had passed, he began to suspect that she had

made a secret treaty with the Empress Elizabeth of Russia and the king of Saxony to make war against him. His suspicions soon deepened into certainty, and he began what is known in history as the Seven Years' War.

It is impossible in a short space to tell of all that Frederick did in these seven years. Austria, Russia, France and, later, Sweden were opposed to him, and his only ally was England. England, who was engaged in America in what we know as the French and Indian War, could not give him men, but she did give him money, without which he could not have carried on the fight. Frederick won many victories, of which the most famous is Rossbach, where with 22,000 men, he defeated an army of 50,000. His personal bravery was very great, and he became the idol of his soldiers. But the odds against him were great. In one battle he fought so recklessly that an officer asked if he meant to take a battery single-handed. He met many defeats and once he became so despondent that he was tempted to take his own life. Once he was slightly wounded, and narrowly escaped being taken prisoner, and another time, his clothing was riddled with shot.

As the years went on it seemed as if the war must end in Frederick's complete overthrow. The climax of his woes was reached when his uncle George II of England died. George III, who cared nothing for Frederick, made peace with France, and Frederick was left without support. The same year, however, the empress of Russia died. Her successor, Peter III, was Frederick's greatest admirer. He at once made peace with Prussia. The Russian armies were ordered home, and Frederick was saved. His only opponent now was Austria, and though the war dragged on for another year, both countries were exhausted and a peace, which left him in possession of Silesia, was signed in 1763.

FREDERICK SHOWED HIS REAL GREATNESS IN TIME OF PEACE

It was now that Frederick showed his real greatness. Few men could have risen as he did to the task of bringing back prosperity to his ruined land. The country had been reduced to penury, but it was not in debt, for there was nowhere that Frederick could borrow. He had somehow got enough money to carry on the war for another year, and this he used to help the people. The army horses were used to cultivate the land, seed was bought and distributed, and by degrees houses were rebuilt, and commerce and industry built up again.

About ten years after the close of the war he shared in the first partition of Poland. This partition completed the ruin of Poland, but brought Polish Prussia, which had hitherto divided Brandenburg from East Prussia, under Frederick's rule and greatly strengthened his position in the empire. Some people have tried to lay the whole blame for the partition on the empress of Russia, or even on the Emperor Joseph, Maria Theresa's son. There is little doubt, however, that the chief fault was Frederick's. He wanted Polish Prussia. When he saw an opportunity to get it without the cost of a war, he took it, and there can be no justification for his act.

Much suffering has come from the partition of Poland, and the people have always been restless and discontented under the foreign rule to which they have been subjected. In 1919, as one of the results of the Great War, Germany was forced to give back this province and other Polish territory besides to the New Polish states.

FREDERICK THE GREAT TRIED TO UNITE NORTH GERMANY

Some years later, when the elector of Bavaria died, another quarrel with Austria was threatened. But Frederick feared to bring on another dreadful war, and the matter was settled by treaty. Then Frederick began to think of making a union of the North German princes to curb the power of Austria. Before he died, he partly succeeded, and the League of Princes which he formed was the germ from which grew the idea of the present German Empire.

In his old age, his people called him "Father Fritz," a title that was very dear to his lonely heart. He suffered much from gout, but, nevertheless, he continued to work as hard as in his youth. In August, 1785, he held a review at which Lafayette was present. Rain fell heavily, and the king got a chill, which brought on an attack of gout. During the next year he gradually lost strength, and died on August 17, 1786, in the seventy-fifth year of his age.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4625.

FLOWERING LOCUST

The common locust has such handsome foliage, and such quantities of fragrant white blossoms, that it was planted extensively in European parks.

FLOWERING RHODODENDRONS

Rhododendrons, both native and foreign, are frequently planted in cool and shady places, for their evergreen foliage, and splendid heads of flowers.

FLOWERING DOGWOOD

Dogwood trees grown in an open field look like small apple trees. The foliage takes on brilliant scarlet lines in fall, and the close clusters of berries are even redder. The white flowers make a fine showing.

MOUNTAIN LAUREL

Mountain laurel is one of the handsomest of American evergreen shrubs, and is often transplanted to parks and gardens. Its flowers, which shade from white to a beautiful pink, bloom in June.

STRIKING NORTH AMERICAN SHRUBS

CONTINUED FROM 4480

ONE usually thinks of a shrub as quite tall, rather like a small tree, or at least like a bush, yet some shrubs creep along the ground and others climb high into the trees. To put it as plainly as possible, a shrub is a woody plant that does not die down to the ground each winter, but keeps its side-shoots from year to year, breaking into bloom each season from buds on these shoots.

Trees soon lose their side-branches, at the base of the trunk, as they grow taller, and shoot up into tall shafts, crowned by most of the branches, growing in a head. Upright shrubs, on the contrary, retain their lower branches more frequently and become "bushy" in appearance.

THE TRAILING ARBUTUS, SOMETIMES CALLED MAYFLOWERS

Among the shrubs that creep, is one that grows in many parts of eastern North America but is particularly dear to the people of Massachusetts. It is the trailing arbutus. It grows during the summer, shooting out long branches that trail along the ground, taking root here and there. Its leaves are oval, or almost round in outline, leathery, rigid and evergreen. By autumn, the clustered buds at the end of the hairy twigs are almost ready to open. But they do not do so. Cold weather sets in, dead leaves drift over the plants, and, singularly protected by them, the arbutus waits until the spring sun warms it; then the flowers have but little growing to do, and soon open, among the first flowers of the season. Without doubt they were the first pretty flowers the Pilgrims found. Mayflowers they are called sometimes, and, very frequently, May-pinks.

The flowers themselves are salver-shaped, waxen, and pink or white. They have a delicious "woodsy" fragrance that reminds one of sweet birch and wintergreen, the spicy little evergreen shrub, that is so close a relative of the arbutus, for, with the laurel, the azalea and the bearberry, they both belong to a large family—that of the heaths—which contains a great many odorous, white or rosy-flowered shrubs.

PINK AND WHITE AZALEA OR PINXTER-FLOWER

The lovely pink azalea, or pinxter-flower, as it is quaintly known from its

Copyright, 1911, 1918, by M. Perry Mills.

habit of blooming about Whitsuntide, or Pinxter, in early spring, is also called wild honeysuckle, and not without some reason, for its lovely coronets of delicately cut, long-tubed flowers, poised on slender, brittle stems, do suggest honeysuckles, except for their color. The resemblance is aided by the quintette of very long stamens and two pistils, which are thrust out far beyond the petals. This character would lead one to suppose that wind carried the pollen from flower to flower. But the pollen grains are so coated with a viscid substance that strings of them may be drawn from the anther-cells by the slightest touch of the finger. This leads one to believe that insects are the messengers desired. The rich fragrance of the pinxter-flower would also seem to be an attraction for insects. There is a white azalea, that blooms in midsummer, in swamps, that is still more fragrant.

THE EXQUISITE FLOWERS OF THE MOUNTAIN LAUREL

The mountain laurel, or kalmia, however, although very closely related to the azalea, is scentless. But so brilliant is the display of bloom on this evergreen shrub, which sometimes grows ten feet or more high, that no odor seems necessary even at night. It bears great flat-topped masses of flowers, ranging in hue from white to deep pink, set off, like an old-fashioned bouquet, by a salver of stiff, shining lance-shaped leaves, very dark green in color. Each flower is worth studying. It is like a saucer, which has a five-sided, rather than circular, rim. At each angle, and in each space between the angles, is a small pocket, which projects on the outside like a little knob. Look at a newly opened flower. You will see that each one of the ten pockets has the tip of one of the ten stamens safely stowed away within it. Its filament springs in an arch from the centre of the blossom. Run your pencil over the tops of the arches. You will probably jump with surprise, for every one of those stamens has jerked its tip out of its pocket, and is standing stiffly erect. Now if your pencil had been a blustering bumble-bee, he would have been well thumped by the upspringing stamens, and well dusted by the pollen jerked out of the open mouths of the pair of quaint jugs that form the anthers. He would have flown away, disgusted, and lit on another flower, whose trap had been previously sprung, perhaps, and would have rubbed off some powder on to the ready stigma. Thus he would have done what was expected of him, and the laurel seeds in the second flower would have been benefited in a way that it would take too long to explain, but which results in the contents of the pollen-grains getting down to the very young seeds through the pistil.

Masses of laurel leaves, as they endure transportation well, are stripped from the bushes and used for holiday decoration. One should be careful about throwing them, when discarded, within reach of young browsing animals, for this foliage contains a poison more deadly than strychnine, and many animals have been killed by eating it. Sometimes children are poisoned by eating the young seedling plants instead of wintergreen, which they much resemble, although they lack the spicy taste. Honey made from laurel bloom is also said to poison those who eat it. The narrow-leafed laurel, which is much smaller, with darker, smaller flowers, is known as lambkill, sheep-poison, etc., showing that its dangerous qualities are suspected.

THE PLANT ON WHICH THE LUSCIOUS BLUEBERRY GROWS

There is a group of relations of these gorgeous shrubs that are very plain in appearance, crowded with little drooping white or rose-flushed, bell-shaped flowers, that, in one case, at least, fairly tinkle when the bush is gently shaken. Whortleberries, some of them are called in Europe, or bilberries, but in America we lump several kinds under the name blueberry or huckleberry, having a vague intention of calling by the first name those that are blue, with a waxen bloom like a grape, and the shining black fruit by the other. Where these berries grow at all, they usually grow in great patches, and many women and children in the country earn many dollars each year by picking and selling the little berries, that are so crowded on the branches that they may be plucked in handfuls.

The Indians (as well as the bears) knew how good they were, and put them into their porridge, or into the corn-cakes they cooked by the camp-fire. But huckelberries now are almost as seldom cultivated as they were when Indians roamed over the rocky hillsides and

THE STRIPED MAPLE

The striped maple, or moosewood, is one of the most charming of our smaller trees, both in flower and fruit. Its buds afford a food for large deer.

THE BARBERRY

The common barberry bushes are not native, having been brought here from Europe, but there is a different native American species in the Alleghanies.

THE AZALEA

Azalea flowers of different varieties resemble one another very much. The pinxter-flower blooms before the leaves are fully expanded, but the white azalea is set off by fully grown leaves.

THE HUCKLEBERRY

The common blueberries, or huckleberries, grow thickly on low, stiff, branching bushes, the berries appearing soon after the flowers. The leaves, in autumn, take on very pretty lines of scarlet.

sandy patches where they grew. In certain districts, however, large tracts are taken care of, and burned over very early in spring every two or three years. This kills small trees and weeds among the low blueberry bushes, which grow very quickly, and bear their best crop the year after they are burned over.

SEEDS OF THE RED CHERRY CONTAIN POISON

The Indians probably could not get much comfort out of the wild red cherries, for the flesh is very thin and very sour, but birds gorge themselves upon the plentiful, scarlet fruit, and at least one little animal, the gray chipmunk, nibbles away at them wherever it can reach the clusters of fruit. When in flower, this slender little tree of our rocky woods is wreathed in a veil of tiny, star-like, snow-white blossoms. It would be well to regard this cherry with some suspicion, for the leaves of the more common black cherry, with racemes of fragrant flowers and of shining black fruit, are very dangerous to cattle (when partly wilted, especially), and it is probable that the other species would be equally so. And children should not swallow cherry seeds of any kind, for concealed in them is a wonderfully active and prompt poison, *prussic acid*, which may be set free in the stomach. It gives the pits the taste and odor of bitter almonds.

Blooming under the wild red cherry, are the straggling bushes of the choke-cherry, from which hang long clusters of luscious looking scarlet berries, which will pucker the mouth and throat most amazingly.

THE STRIPED MAPLE, OR MOOSE-WOOD—A MINIATURE TREE

We are all familiar with the great maples, so often planted as shade-trees, such as the scarlet, the sugar and the Norwegian kinds; but there is a delicate little maple that we rarely see, unless we travel on the mountains or in the northern forests. It is uncommon, even then, outside of the woods themselves. It seems to be happy only in thickets of low trees covering rocky hillsides. In the north woods the hunters know it as moosewood, for those great deer, the moose, feed upon its large red-scaled buds. The other name of striped maple is quite apt, for its smooth dark-green bark is lined up and down with delicate tracings of a white pigment that can be scraped off with the nail. It is a tree that Japanese artists would like to draw, for its great, soft, triple-pointed leaves are arranged in a fine spray, and from the twigs spring delicate pendent clusters of pale yellow bells, like fragments of necklaces; and, late in summer, follow strings of pale-brown winged fruits that turn to gold when the rays of the setting sun strike through them.

FLOWERING DOGWOOD FILLS THE WOODS WITH BLOOM IN MAY

In the same woods as well as those farther south, and very widely distributed, are the dogwood trees, the name being borrowed from a small European tree, closely related to it, from whose bark a healing wash for dogs used to be extracted. In May they become snowy banks of bloom, but each apparent blossom is masquerading in a white domino. In the centre of the large white petals—as those who are not botanists very naturally call them—which form the domino, are grouped the maskers or real flowers, each quite complete in itself,—a pale, somewhat slender floweret, four-parted at the margin. The snowy, striking, heart-shaped leaves we have called petals, are really "bracts" (a form of leaf that enfolds, or closely attends a flower) which cover the flowers in the little square buds. At that time they are quite green, but gradually become white as they unfold and expand. They serve to attract insects by making the tiny flowers very conspicuous, and also provide a platform upon which flying creatures may alight, so that they may search easily for, and suck up, the nectar from the very bottom of the yellow flower-vases.

If we wish to see how the dogwood flowers would look without their brilliant bracts, we may search in thickets or in woods for other varieties, mostly low shrubs. Some of them are quite common along roadsides, while others, and especially the round-leaved dogwood, prefer shady and rocky woodlands. The latter has a flat-topped cluster of starry flowers, a little larger than those of the flowering dogwood, and quite white, but it has no brilliant bracts.

THE BARBERRY

Along roadsides we may find the barberry, a tall bush, very straggling in

WILD CHERRY

Birds are exceedingly fond of the small tart drupes of this tree, which is common in rocky woods. Its delicate white flowers are borne in great profusion.

ROUND-LEAVED DOGWOOD

This shrub grows in rock., shaded woods, where its small, white flowers in clusters are effectively set off by the pale round leaves. The fruits are light blue.

THORN-APPLE

The thorn-apples are not properly shrubs, since the rank branches are killed each winter. The small seeds that slip out of the ripe fruit are poisonous.

TRAILING ARBUTUS

This evergreen shrub is often called Mayflower or May-pink. It is also known as gravel-plant on account of certain curative powers it possesses.

its growth and crowded by a host of suckers. It has come from the Old World, but has become so much at home here that we forget that fact. It throws out long, slender and brittle branches, studded with tufts of small, obovate or spatulate leaves; but as soon as we pick a spray we discover that it is very fully armed with sharp spines that point in every direction, and are leaves that have been transformed entirely into spines like those of the cactuses. In fall the ordinary foliage falls off, but the spiny leaves remain, ready to keep browsing animals away from the tender, growing twigs.

Racemes of pretty yellow flowers droop from the tiny barberry shoots in spring, in which the nectar is produced in saffron-colored swellings, on the petals, and also on the filaments of the interior circle of stamens; for the six pollen-bearers stand in two whorls, slanting outwards and lying in the concave faces of the similarly placed petals. The bases of these stamens are very sensitive, and when a bee flies upward to the drooping flower—that, like a roof, protects its stamens from rain—and plunges her feet or proboscis therein, seeking honey, she sets off a trap, as it were. The stamens fly upwards at the slightest touch, toward the stigma, and tap the bee smartly on the head, snapping open the little trap-doors at the top of the anther, and powdering the visitor thoroughly with pollen. The later racemes of oval scarlet berries droop from the bending branches during almost the whole winter. They are very acid,—too tart to interest many birds. But they make delicious preserves, with a very distinct flavor.

THE BEAUTIFUL FLOWERS AND FEATHERY LEAVES OF THE LOCUST-TREE

The tulip-tree grows best in damp soil but the locust-tree thrives best in dry and sandy land. It has a somewhat tropical look, reminding one of the African mimosas, for its leaves are divided into many rounded leaflets. Its spray, seen against the sunset light, looks like delicate sea-weed, and the tree itself, when uninjured, suggests instantly the gray-tinted ones seen in the landscapes of the older French painters, or of Corot; or, to use a more commonplace comparison, like quaint old pencil-drawings. However, the flowering locust is rarely seen in fine condition, for its branches are extremely brittle, are usually injured by borers, and some are apt to crash down in every storm. In June it is a glory of bloom. Great clusters of racemes of pea-like flowers droop from every branch, white, with golden hearts, an American rival of the Japanese wistaria with the added virtue of very great fragrance.

But one must approach the tree with caution, for it is defended by vicious thorns, while stray thorns are scattered here and there on the main trunk, even near the ground, where we do not expect them. Brittle as the branches are, the wood, when properly seasoned, withstands decay admirably, especially when in contact with the soil, and is greatly sought for fence-posts.

Even more tropical in appearance than the locust is the stag-horn sumac with its crooked branches covered with thick, soft hair, not unlike the velvet of a young deer's horn. Its closely set, pyramidal masses of acid fruits are also wrapped in crimson plush, as well they may be, for they crown the awkward brittle stems until spring, or as long as the birds will let them stay. Although sour and dry and velvety and difficult to swallow, they offer a sort of hard, unnourishing food to many a bird hard pressed by hunger in the winter season. Chickadees fairly haunt them, and cheerily peck the pyramids to pieces.

POISON-SUMAC IS DANGEROUS TO TOUCH

While we are prowling about the margins of swamps looking for the pin-oak, we must take care not to run into, or handle, the *poison-sumac* or swamp elder as it is sometimes called. It is most dangerous in early summer, for then the flowers are opening, and even the flying pollen seems to be quite able to cause that itching inflammation of the skin which tortures some people so greatly, whether caused by the poison-ivy of the fence-posts, or by its relative the poison-sumac of the swamps. This is a shapely shrub or small tree, which often grows among alders and elders. Its rather long and bare, slender limbs bear at the top a great cluster of leaves composed of from seven to thirteen pointed leaflets. These *stand up* from the mid-rib in a way that is quite unlike the attitude of the leaflets in other trees. They are very glossy, of an odd shade of dark green above, and have red stems, while the mid-rib from which they spring

POISON-SUMAC

A shrub or small tree which grows in swamps, that is to be avoided. It is poisonous to the touch. It has upstanding leaflets on red stems, and white berries. The foliage turns a beautiful red in autumn.

POISON-IVY BERRIES

This shrub may be easily recognized in winter by its grape-like dry clusters of white berries, and in summer by the entire-edged up-standing leaves on red stems. The fruit of the common sumac is dark red.

THE BITTERSWEET

There are two vines called bittersweet. This one, with scarlet and orange berries, is quite harmless, although the other is considered poisonous.

POISON-IVY SPRAY

It should be remembered that the poison-ivy may affect the skin even in winter, when the leaves have fallen, if the fruit or twigs be handled or bruised.

is also red. This is a point to be remembered! The little green flowers fall loosely in long spray-like panicles from the axils of these leaves. In the fall, the leaves very early change to unusually brilliant shades of orange and vermillion, and when they have fallen to the mud, grape-like clusters of white berries still grace the tops of the branches, tempting birds to eat them, and occasionally, I fear, tempting young folks with an eye for winter decoration, to pick them—with sad results—for root and branch, winter and summer, the poison-sumac is poisonous to the touch. Practically the same thing can be said of its more common cousin, the poison-ivy, which crowns fence-posts and old stumps and rears its slender branches among the thickets. This, however, has only thin leaflets, without the warning red stalks, but has the same gloss on its dark green leaves, and assumes the same brilliant autumnal coloring.

W. H. Gibson has given us a catchy little jingle about the sumacs which may help us to remember the important differences between the poisonous and harmless sumacs.

"Berries red,
Have no dread!
Berries white,
Poisonous sight!
Leaves three,
Quickly flee."

One should be cautious, moreover, in going to the leeward of a fire in which the poison-shrubs are burning, and should never chew bits of wood without first examining them; the smoke from the burning, or the chewed-up splinter of bark may result seriously even for persons who are not usually affected.

POISON-IVY SHOULD BE SHUNNED

Although not quite so virulent as the swamp or poison-sumac, the poison-ivy, its close relative, is quite as dangerous. It is much more common, springing up in many an old field and woodland clearing, and climbing upon roadside fences, where it thrusts out its short branches into the faces of the passers-by. It climbs by means of rootlets protruding from the bark, and each leaf is made up of three leaflets of an irregular lobed, ovate outline. The number of leaflets is to be remembered, for the poison-ivy is continually entangled with the innocent five-leaved Virginia creeper or ampelopsis. The spreading of the poison-ivy is largely due to the birds, who devour the berries eagerly, pallid, hard-shelled and unappetizing as they look to us. Some of the seeds passing through the bodies of the birds fall uninjured and proceed to sprout.

THE BRILLIANT BERRIES OF THE BITTERSWEET

A much more gaudy climbing shrub is the bittersweet, that sometimes shares the fence-posts with the poison-ivy. During the summer one hardly notices the pale vine, as it climbs by twisting its supple branches around trees and other supports. One will sometimes find small trees in a grove, with a swollen portion around which a welt or groove winds spirally. This is a sign that some vine, and usually a bittersweet, has enwrapped the growing sapling so firmly that it has nearly strangled it, and forced it to grow in an unusual manner where the vine pinches, just as one's finger swells about a tightly tied string. Shade, or the upgrowing of the tree, generally kills the vine, and leaves the sapling free, but sometimes fragments of bittersweet are embedded in the bark. In fall, the orange colored berries of the bittersweet split into four portions, that bend backwards and leave exposed a fleshy scarlet sphere, called an aril, that covers the seeds. Scarlet and yellow placed together make each hue more brilliant, painters say, and doubtless these gaudy berries catch the eye of the birds, and are carried afield by their means, as are those of the poison-ivy.

THE DANGEROUS THORN-APPLE, SOMETIMES CALLED JIMSON-WEED

Near the end of this very short list of shrubs I put the thorn-apple, for it really is not a shrub at all, since each year the stalks are laid low by frost. However, it looks so much like a great widely branching true shrub, and it is so dangerous, that I shall speak of it here. Its unshapely, lobed, dark green leaves, rank in odor and arranged in clusters separated by long spaces of bare stem; the toughness of its branches; and above all its morning-glory-like flowers, that bloom at night, and round spiked fruit, make it easily recognized. An interloper from the tropics, it thrives very well on our dust-heaps and road-

sides and grows rankly, forming thickets on the vacant lots of cities.

There are two common sorts, one bearing exquisitely white flowers; the other, blossoms with violet corollas, and having purple stems and shades in its foliage.

The thorn-apples or daturas are sometimes called Jimson-weed, a shortened form of Jamestown weed. They are so called because certain soldiers, eating its young sprouts near Jamestown, Va., in colonial times, soon became delirious and acted as if half mad. This was because, while not poisonous to the touch, the thorn-apples are narcotically poisonous when eaten. Large amounts throw the victim into a fatal stupor, but in slighter quantities induce delirium. Luckily, the fruit is not very tempting. The green, fleshy, ball-like capsules soon become dry and brown, and are thickly beset by long but not very sharp prickles. It soon splits open downwards from the top, usually into four pieces, and the thin little black seeds can be plainly seen. These are the most dangerous parts of the plant, and children should be warned not to nibble them.

It is these shrubs, growing low and in dense clusters, that form the thickets that make an attractive and sheltering border along the outskirts of the woods. They flourish in a continuous fringe by the banks of country streams, arching over the currents and reaching out on the sunny side into rounded masses of foliage. Standing upon a hill-top one can trace the winding course of streams, whose water cannot be seen at all, by the green cushiony line of bushes that marks their course. Such thickets are the favorite resort of small birds, which find among their recesses plenty of the insects or of the small fruits upon which they feed, while they feel safe among the close twigs where they cannot easily be seen by hawks or other enemies, of which birds live in constant fear when they are out in the open. Few small birds spend much of their time in the tall trees, and so they seek the thickets of shrubs.

Here, too, insects, snails and such small creatures live in the shaded soil and decaying leaves. These attract the toads, wood-frogs and turtles; and after them go snakes and various of the smaller mammals, wandering rabbits, woodchucks, raccoons, foxes and so on.

HANDSOME RHODODENDRONS AND OTHER EVERGREEN SHRUBS

Although the Himalayas appear to be the haunt of most species of rhododendrons, America possesses several of these lovely flowering shrubs. The most beautiful ones live chiefly on mountains, occasionally creeping down their flanks, however, into cool shadowy glens of the lowlands. They arrive at their greatest size, that of small trees, in the southeastern mountains, where they are called "laurel," or rose-bay, bearing great clusters of pink, or white, spotted flowers, jutting out from massy foliage of dark, shining evergreen leaves.

Another evergreen shrub of the South, is the climbing "smilax," closely resembling its allies, the "catbriers" of the North, whose twining stems, set with stiff leaves, are frequently sent North for Christmas decoration, along with the prickly foliage and scarlet berries of holly.

The black alder, of swamps, which loses its foliage, but is strikingly adorned with close-crowded vermilion berries, is also a holly, like the gay winterberry, the ink-berry and the inconspicuous cassine or yaupon, whose leaves are dried for rustic tea-drinking, and were formerly used by Indians for brewing the sickening "black-drink" with which they ceremonially dosed and purified themselves. The leaves of the New Jersey tea, a widely branching little shrub, every twig tipped with bunches of tiny white flowers, were said to have served in an infusion, for a beverage; but the use of Labrador tea, woolly and astringent, appears to be more frequent in those sub-Arctic regions where it grows.

The Southwest has a shrub, the mahonia, "which looks like a holly, fruits like a grape, and is a barberry." It is frequently seen in modern shrubberies, but although evergreen in its own home, will lose its foliage in the North if not protected, thus unduly exposing its blue fruit. In the warmer parts of California, are found also the manzanitas, very conspicuous among other shrubs of the chaparral, on account of their smooth red branches, pale foliage, and large dark-red berries.

The witch-hazel, that sprawls in young forests, has flowers like rosettes of tiny golden ribbons. Its big ugly leaves are distilled and used for the familiar lotion.

THE NEXT NATURE STORY IS ON PAGE 4653.

TWO OF THE OLDEST UNIVERSITIES

Harvard is the oldest university in the United States, and Massachusetts Hall is the oldest building of the University. Harvard has many buildings, very much larger and more costly than this simple structure, which was built in 1720. The General Court of the colony of Massachusetts Bay voted to establish a college in 1636, and two years later John Harvard, a young minister, gave his library and his estate.

Though Princeton is one of the old universities, this is one of the newer buildings. It is called Holder Hall, and is used as a dormitory. The institution was founded at Elizabeth in 1746, but was moved to Princeton in 1752. The official name was the College of New Jersey until 1896. The situation of the institution is very attractive.

Pictures from Press Illustrating Service, Inc.

The Library and Other Buildings of Columbia University

AMERICAN COLLEGES AND UNIVERSITIES

IN the United States there are many schools for higher education which we call colleges or universities. Some lists have nearly a thousand—more than in any other country in the world. In Europe the words are used very carefully, and the schools themselves are under strict laws. In the United States the national government does not control education, which is left to the states.

Some of the states have strict laws, and some have almost none. Some will not allow a school to call itself a college unless it has proper buildings and money enough to pay a certain number of professors. Others allow any school to call itself a college or university. The result is that some of the colleges and universities are as good as those to be found anywhere in the world, while others are little more than academies or high schools.

THE DIFFERENCE BETWEEN A COLLEGE AND A UNIVERSITY

It is hard to say what is the difference between a college and a university in the United States, as the words are used very carelessly. This understanding is growing, however. A college is a school which takes boys or girls, or both, after they have finished an academy or high school. They attend at least three years, generally four, and, if they have passed all their examinations they get a degree such as Bachelor of Arts or Bachelor of Science. This gives them the right to place A. B. or B. S. after their names, and means that they have taken the first step in learning. Such a college may be a part of a university, or may be independent.

A university is a collection of several schools or colleges. Besides the college for general education, there are usually special schools for such subjects as law, medicine, dentistry, engineering, mining, agriculture, education, journalism, and the like. Not every university will have all of these, but it should have some of them. Besides it should have a school to train graduates of the colleges still further. When you see such letters as Ph. D., or D. Sc., after the name of a man or woman, it means that he or she has gone through a college and has then spent several years in studying a very few subjects, giving most of the time to one. This is what is meant by having a doctor's degree in mathematics, for example. The person who has this, spent most of his time study-

Copyright, 1918, by M. Perry Mills.

ing mathematics, but probably studied physics also, and perhaps another subject or two.

HOW SOME OF THE GREAT UNIVERSITIES BEGAN

Some of the great universities in the United States began as simple colleges and grew into universities, as they increased in attendance and wealth. This is true of Harvard, Yale, Princeton, Columbia and others. The men in charge of some colleges have not wished them to grow into universities, but have preferred to have them do college work well. These colleges give only a bachelor's degree, but the work done in such institutions as Williams, Amherst, and others, is quite as good as that done in any college which is a part of a great university. Counting together the colleges belonging to universities and the independent colleges, there are about one hundred and fifty of high rank in the United States. The others have not a high standard, or do not do such thorough work.

Some of the universities, which have been established later, had several schools when they opened. This is especially true of the institutions in the West, which were founded by the state, and of some of the new universities to which wealthy men have made great gifts. As we said before, there are others which have no right to the name university at all. Wealthy men have also made large gifts to colleges and universities already established. Many of the institutions established as church colleges are now independent, but some churches still support and control many colleges.

HARVARD, THE FIRST COLLEGE ESTABLISHED IN THE COLONIES

The first college founded in what is now the United States was Harvard, which was begun in 1636, only a few years after the first settlers came to Massachusetts. It was named for a young minister, John Harvard, who left the college his library, and £400, when he died. It was little more than an academy at first, and the boys were publicly whipped if they broke the rules. Now it has thousands of students, scores of buildings and hundreds of teachers.

The next college opened in the colonies was William and Mary College at Williamsburg, Virginia, founded in 1693. It was prosperous down to the Revolution, but has never grown as some other colleges have done. Many distinguished men studied here. We can mention Presidents Jefferson, Monroe, and Tyler, Chief Justice Marshall, and General Winfield Scott.

Yale began as a school for the training of ministers, in 1701, and was located wherever the president lived at first. In 1716 it was decided to move the school to New Haven, and from small beginnings it has become famous. It was named for a Welshman, Elihu Yale, who made the first important gift to the school. Princeton was founded at Elizabeth (then called Elizabethtown), New Jersey, in 1746, but was soon removed to Newark. In 1756 the college was removed to Princeton, where it has remained ever since. Though called Princeton, soon after it was moved to that town, the real name was the College of New Jersey at Princeton, until 1896, when it became Princeton University. President Wilson was student, professor and president at Princeton.

NINE COLLEGES WERE FOUNDED BEFORE THE REVOLUTION

Nine colleges, which still exist in what is now the United States, were founded before the Revolution, and before 1800 there were twenty-one. Some of these were King's College (now Columbia) at New York in 1754, Queen's (now Rutgers) at New Brunswick, New Jersey, in 1766, Rhode Island College (now Brown University) at Providence in 1764. Dartmouth began as a school for Indians, in Connecticut, but was moved to Hanover, New Hampshire, in 1769. Though called a college, this school now has some of the departments of a university. Bowdoin and Williams were also founded before 1800.

Nearly all of these colleges were founded by different churches, but now we come to those of a different kind. What we now call the University of Pennsylvania was founded as a charity school in 1740, and through the help of Benjamin Franklin was much improved. It was soon called the College and Academy of Philadelphia, and in 1791 received its present name. The University of North Carolina at Chapel Hill was given a charter in 1789 and was opened for students in 1793. These are the oldest of the state universities. Though the University of North Carolina was

YALE AND THE UNIVERSITY OF VIRGINIA

Yale University began as a school in 1701, and classes were taught in different places. A lot was bought at New Haven in 1716, and the institution was called Yale College, in honor of Elihu Yale, who made liberal gifts. The college grew slowly at first, but for a long time has been one of the leading institutions in the country. Phelps Hall, through which is an entrance to the quadrangle, is one of the many buildings.

The University of Virginia owes its beginning to Thomas Jefferson, who planned not only the buildings, but the course of study as well. It is located on the edge of the mountains at Charlotteville, Virginia, and was opened in 1825. All the buildings fit into the general plan of President Jefferson. For a long time the University had no president, but members of the faculty took turns in presiding.

the first institution to be called a university, Pennsylvania was already open for students.

MANY STATES ESTABLISH UNIVERSITIES AT PUBLIC EXPENSE

In the years that followed, nearly every Southern and Western state established a state university. As new states were admitted to the Union, Congress set aside great tracts of land to support a university in each state. Some of the states sold the land for very little, but others held on to it until it became very valuable. All the people of these states pay taxes for the support of the universities also, and some of the universities have very large incomes.

We cannot name all the state universities. There are now about forty of them, and so it would be easier to name the states that do not have them. New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland and Delaware have no state universities, though little Delaware has a state college. The University of Pennsylvania is partly supported by the state. There is a University of Porto Rico, and a University of the Philippines. We show you a picture or two of some of the state universities, but we do not mean that these are better than any of the others. Some we have not named are quite as good. The same is true of the other institutions we show.

MANY SUBJECTS TAUGHT IN THE STATE UNIVERSITIES

These universities teach many subjects to their students, and many of them have summer schools where teachers and others come to study for a few weeks. Some have short courses in agriculture to which farmers come to learn better methods of caring for their cattle and other live stock, or to learn new things about planting and cultivating their crops. These universities will teach any subject which will be of benefit to the people of their states. Many of them have several thousand students, and have gained high reputations for the quality of their work.

Several of the larger cities support colleges or universities. The City of New York has a college for men and another for women. Charleston, South Carolina, and Cincinnati, Toledo and Akron in Ohio, also have colleges or universities supported by city taxes. Several other cities in different parts of the country are discussing the question of founding city colleges so that their boys and girls may go beyond the high schools at home.

We have mentioned the colleges and universities founded by churches and those by the states and cities. Now there is another kind founded by wealthy men, who wished to do good with their money. The largest and most important of these are Johns Hopkins University, at Baltimore, Leland Stanford Junior University, at Palo Alto, California, and the University of Chicago. There are many others. Cornell University, at Ithaca, New York, was partly founded by an individual, and partly by the state. It has also received many large gifts.

GIRLS MAY NOW GET A COLLEGE EDUCATION

Not many years ago there was little chance for a girl to get higher education. She was not admitted to the colleges with her brothers, and the schools for girls were not very good. All that is changed now. More than half of the colleges admit both women and men, and there are some colleges for women, quite as good as the colleges for men only. The largest and best known of these are Vassar, Wellesley, Smith, Bryn Mawr, and Mt. Holyoke. A special college for women is a part of several universities, as Radcliffe at Harvard, and Barnard at Columbia. There are several other colleges for women which have high standards. So to-day a woman can get an education almost as easily as a man. The girls at these colleges enjoy themselves quite as much as their brothers do at their colleges, if not more.

COLLEGES OF OTHER KINDS OF WHICH WE CANNOT SPEAK

We cannot stop to tell you of another kind of college to teach agriculture and mechanics, which is found in every state. The United States government has helped to found these. In some states, such a college is a part of the university; in others it is separate. We have not time to tell of the schools which teach science and engineering. Enough has been told to show you that the United States certainly has colleges enough—perhaps more than can be supported properly, for it takes a great deal of money to support a college. When fees are charged they are never large enough to pay more than a small part of the expenses.

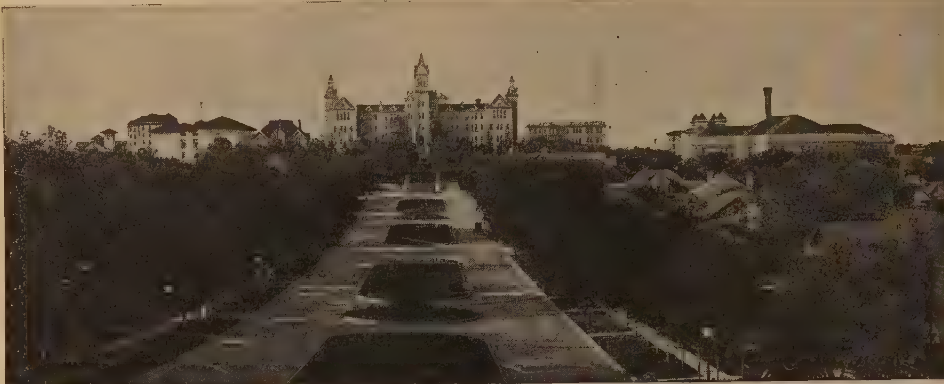
NEXT STORY OF THE UNITED STATES IS IN NEXT VOLUME.

WHAT A CITY AND A STATE ARE DOING

The College of the City of New York has four great entrances. This is called the Hudson Gate, because one coming out of the campus has a view of that river. This college is supported by the city of New York, and is free to any New York boy who is prepared to enter. There is also a night college, a summer college, and many special courses are open to the employees of the city. Some courses are open to women.

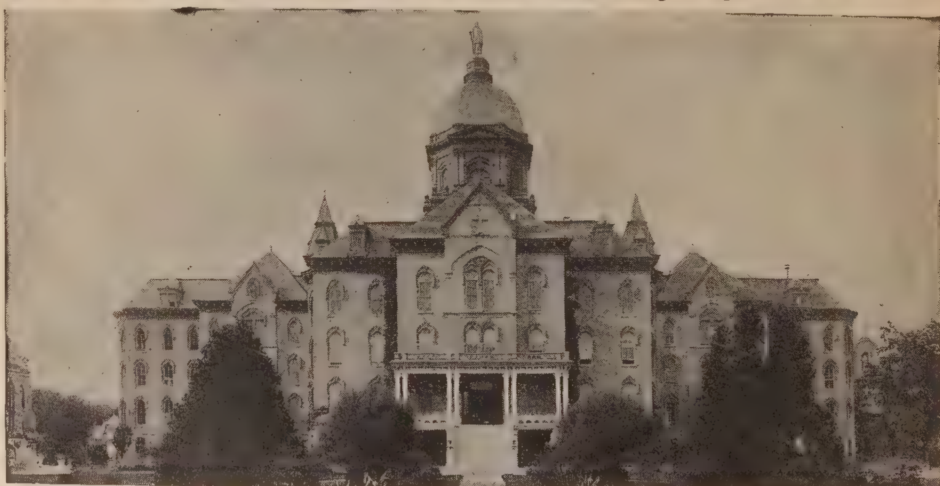
The University of Michigan was opened at Ann Arbor in 1841, and has grown to be one of the largest state universities, with many departments, dozens of buildings and hundreds of instructors. This was one of the first institutions to open its doors to women. This was done in 1870 and over 4,000 women have received degrees. This is one of the older buildings, and was considered a marvel in those days.

THREE INSTITUTIONS OF DIFFERENT KINDS



The University of Texas was opened at Austin in 1883, but the medical school is at Galveston. Besides the college there are schools of engineering, architecture, law, medicine and education. It is open to women also. The state gave 2,000,000 acres of land to found the institution, which is now very large.

Matthew Vassar, in 1861, gave 200 acres of land and $788,000 to found a college for women, which was named for him. This building, which stretches far to right and left behind the trees, was at first the only one, but many men and women have since given money, land and buildings. Some of the dormitories are very attractive and the chapel is beautiful. Vassar was the first woman's college to gain a wide reputation.



The University of Notre Dame, at Notre Dame, Indiana, was founded in 1842, by some members of the Congregation of the Holy Cross, a Catholic teaching order. It includes not only a college but several professional schools which are well attended, and preparatory schools as well. The Administration Building is one of many university buildings.

TWO UNIVERSITIES OF THE MIDDLE WEST

University Hall is one of the older buildings of the University of Wisconsin, one of the largest of the state universities. It is situated at Madison, the capital of the state, and has about forty large buildings, hundreds of instructors, and thousands of students. Besides the college department there are schools of medicine, law, agriculture, engineering and many others, besides a graduate school. The library is good.

The University of Illinois, like most of the state universities, admits women, and this is the building set apart as a home for them. Though Illinois is now one of the older states, it did not fully establish a university until 1885. The University is situated between Urbana and Champaign, though some of the departments are in Chicago, and counts its students by the thousands.

TWO UNIVERSITIES OF THE FAR WEST

The University of Washington was founded before the state was admitted to the Union, but did not grow rapidly in the first years. It is now one of the leading state universities. This picture shows a part of the immense campus inside the city of Seattle. The University will not be cramped as it grows. The University has many different schools, and was one of the first institutions to teach journalism.

One of the most unusual buildings, if it is a building, at the University of California is the Greek Theatre, used for plays and meetings. The theatre is like those of ancient Greece, in which the plays of the great Greek writers were given. The University is situated at Berkeley, and has a fine view of San Francisco and the Golden Gate. It has thousands of students in its many schools, some of which are in other towns.

GLIMPSES OF A CALIFORNIA UNIVERSITY

The buildings of the Leland Stanford Junior University, at Palo Alto, California, follow the old Spanish mission style of architecture. All of the many buildings are connected by arcades of stone.

The University was founded by the parents of the young man whose name it bears as a memorial. The Memorial Church is one of the most lavishly decorated buildings in the United States.

Senator Stanford gave his Palo Alto estate of 9,000 acres as a site for the university, and a large tract has been reserved as a setting for the buildings. The many low buildings connected by arcades of stone, are arranged in two quadrangles, one inside the other. They form a pleasing architectural group, and the beauty is increased by luxuriant vegetation. The lawns are bordered with a dazzling display of flowers.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Un jour Georges alla promener son chien. Il rencontra un garçon boucher.
One day George went to walk his dog. He met a boy butcher.
One day George took his dog out for a walk. He met a butcher's boy.

Il portait de la viande sur un plateau. Pat sauta et vola un gigot.
He was carrying of the meat upon a tray. Pat jumped and stole a leg of mutton.
He was carrying some meat on a tray. Pat jumped up and stole a leg of mutton.

Pat décampa dans la rue; Georges courut après Pat et le garçon après Georges.
Pat decamped into the street; George ran after Pat and the boy after George.
Pat ran down the street; George ran after Pat and the boy ran after George.

Un petit garçon traversait la rue avec une grande boîte sur la tête.
A little boy was crossing the street with a large box upon the head.
A little boy was crossing the road with a big box on his head.

Le méchant Pat courut au garçon, le fit tomber et renversa la boîte.
The naughty Pat ran to the boy, him made to fall and upset the box.
The naughty Pat ran up to the boy, knocked him over and upset the box.

Le garçon était très furieux. Il se releva et suivit Pat pour le frapper.
The boy was very furious. He himself raised up again and followed Pat for him to strike.
The boy was very angry. He picked himself up and ran after Pat to beat him.

Pat courut jusqu'à ce qu'il arriva à une femme qui vendait des pommes.
Pat ran until this that he arrived at a woman who was selling some apples.
Pat ran on till he came to a woman selling apples.

Pat fit tomber la corbeille de la femme et les pommes roulèrent sur la chaussée.
Pat made to fall the basket of the woman and the apples rolled upon the roadway.
Pat knocked over the basket and the apples fell out into the road.

La femme se releva et jetta la corbeille au chien. Pat était enfin attrapé.
The woman herself raised up again and threw the basket at the dog. Pat was at last caught.
The woman picked herself up and threw the basket at him. Pat was caught at last.

On le conduisit à la maison et son petit maître le punit de son espièglerie.
They him conducted to the house and his little master him punished of his prank.
He was taken home and his little master beat him for being naughty.

THE FRIEND OF THE SLAVES

CONTINUED FROM 4452

LADY BAKER

IT is the glory of Britain that she has done more than any other country to abolish the hateful slave trade, not only from her own possessions, but from the very face of the earth. Long after the slaves were freed in her colonies, as a result of the efforts of Wilberforce, the slave trade flourished as much as ever in Africa, and although it has been greatly checked, it is still one of the evils of the Dark Continent.

The first real step taken to stop the slave trade in Central Africa itself was made by Sir Samuel Baker, an intrepid English explorer, who, with his brave young wife, went to the stronghold of the traffic in Africa, and grappled with it there. In 1869, Baker was given, by the Khedive of Egypt, command of an expedition to suppress the slave trade, and he had under him a force of 1,645 soldiers; but the Egyptian officials in the Sudan, who made large sums of money by the wicked traffic, put every obstacle in the way of Sir Samuel Baker, and a man of less determination and spirit than himself would have given up the work in despair.

Everything seemed to go against the brave leader. The river fell low, and his steamers could not travel, and instead of leaving Khartoum with vessels and beasts of burden, he was compelled to go on without steamers and without a single transport animal. His British pluck, however, made him attempt what seemed the impossible, and the gallant Lady Baker, who was the first white woman ever to visit these parts, supported him heroically in his determination. Splendid work was done. On one occasion three boats, belonging to the governor of Fashoda, were seen approaching. Sir Samuel interviewed the governor and asked if he carried slaves on board. The official appeared greatly shocked, and said he was only collecting taxes. But when the vessels were examined, over seventy slaves were found on board, and eighty-four others were concealed on shore. This was an official who had declared to Sir Samuel that he had himself suppressed the traffic, and no slave trader dared have a station in his district.

Sir Samuel and Lady Baker released all the slaves instantly, to the intense joy of these poor people, and the bitter resentment of the governor.

At another time a vessel was seen passing far out in the middle of the river. She was stopped, and the indignant captain declared that he carried no slaves, but only grain. When the corn was prodded with a

ramrod from a rifle, there was a stifled cry from beneath the grain, and a negro woman was pulled out. The whole of the corn was then removed, and 150 slaves were released.

Sir Samuel soon found out not only that Egyptian officials were the principal slave dealers, but that the Government that had sent him to suppress the trade had given to a trader a permit allowing him the exclusive right to take slaves over an area of 90,000 square miles!

Treacherous officers in his own army and mutiny among the troops did not move him; and when he heard that the officers and men had determined to give up the expedition and return to Khartoum, thus leaving the slaves to their fate, he wrote in his diary: "Not a man shall go back, except by my orders." And yet, strong and firm as he could be, Sir Samuel was moved to tears by the sight of a little slave boy of eleven, who escaped to his boat, covered with wounds.

The force of 1,645 men was reduced to 502 all told, but the brave leader kept heart. "I did not despair," he says. "I determined that this reduction of military force should not paralyse the activity of the expedition, and that in spite of every intrigue I would succeed in the main object of the enterprize; the slave trade should be suppressed." Continuing south, he came with his wife and a small force to Masindi, near the Victoria Nyanza. The king appeared friendly, but Sir Samuel Baker felt it necessary to take precautions. The continued friendliness of the king disarmed him somewhat, and then one evening, while Sir Samuel was walking up and down, talking to Lady Baker, fire was opened upon them from the neighboring bushes. Fortunately they escaped, but the station was surrounded by thousands of armed blacks, who were repulsed only with difficulty.

Sir Samuel's good work has since borne fruit, for the slave trade has now been suppressed in the parts which he visited. At the close of his book on the expedition he says: "I must acknowledge the able assistance that I have received, in common with every person connected with the inland expedition, from my wife, who cared for the sick when we were without a medical man, and whose gentle aid brought comfort to many whose strength might otherwise have failed."

Livingstone, the missionary, in one of his letters, says of Baker: "He is now employed in a more noble work than the discovery of the Nile sources, and if he succeeds in suppressing the slave trade, the boon he will bestow on humanity will be of far higher value than all my services together." Baker died in 1893, after many years of useful service.

A WOMAN WHO SAVED HER FAMILY

A LADY was spending a holiday in Switzerland with her two children, and one day, desiring to reach a valley on the other side of the mountains, she ordered a carriage to drive the family over the pass.

Now, most mountain passes have one or more dangerous spots on the road, where a driver has to use all his skill to keep his vehicle from falling off the narrow road into some depth below. In this case there were three horses to draw the carriage—a leader in front and two abreast behind him.

All went well till the carriage came to an awkward place in the road, where rocks overhung it on one side, and a steep precipice shelved down on the other into the valley hundreds of feet below. Just at the critical moment the leading horse became scared at something, turned aside towards the precipice, then, sticking his forefeet over it on the top of the incline, tossed his head and stiffened his body, preparatory to making a dash forward.

A scream from the children, and the poor frightened animal would have plunged them all into the valley below. The driver quite lost his presence of mind, and stared helplessly in front of him, as though he were paralysed.

But the mother in the carriage behind knew that a moment's delay meant death, and, with the courage born of mother-love, jumped out on the road, and, quick as thought, ran to the head of the leader, seized the bridle with her right hand, and, covering his eyes as well as she could with her left, spoke soothing words as she tried to back him up on to the road. She found this very difficult to do, but in the end she managed it, and so saved them all from impending destruction.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4599.